Chapter 1
Introduction: Succeed in Residential, Commercial and Industrial Environments

Abstract The introduction and documentation encompasses over 500 distinctive service identities within the agricultural, marine, industrial and commercial environment utilizing tools energized by high-pressure water. Portrayed are the industry specific application diversities and its established correlating safety requirement. The business and technical introduction offers the research and ground work to support and shore-up services-sales, tooling and equipment choices by presenting the correct application approach to customers within 24 commercial-industrial sectors. The introductory business model establishes independently the confidential procurement procedures and narration of application methods, technique and processes to safeguard corporate application itinerary voiding the loss of application technology and know-how to various and often repetitive circumstances.

1.1 Agricultural Environments, Cattle-Hog-Poultry Operations, Animal Pounds, Horse Stables, Kennels-Zoos-Aquariums, Veterinary Facilities

The great number of animals held in today's confined production, transportation, holding or display facilities situated often in remote or isolated locations, result in distinctive pressure-washing and hydro-blast application varieties and services. The encountered acidic and highly humid environment generally poses a specific threat to humans and animals alike, accelerating bacterial growth, pest development, corrosion, coating and concrete deterioration.

In this atmosphere, contractors and service providers must establish a biological security program encompassing operational exterior–interior cleaning requirements for buildings, equipment and surfaces in feed storage facilities to protect

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Fig. 1.1 On demand chemical metering pump

Fig. 1.2 Flock breeding facility

animals and humans alike (biosecurity, Fig. 1.1). This also includes and involves the controlled behavioral requirement of contractor's labor force, tooling and pressure washing equipment introduced to the jobsite. A contractors' biosecurity program can only be successful when pooled with the customer's operational circumstances, on-farm-facilities compulsory HACCP system (hazard analysis and critical control point) which incorporates the existing integrated pest-bacterial management programs. Visiting and conferring with local veterinarians in regards to past history and possible conclusions of flock pest-infectious-disease control requirements pertaining to the job site and general surrounding areas is a welcomed and necessary practice to support a qualified bid procedure.

Suitable future or rotational chemistry applications, specifying disinfectants, biodegradable soaps, bacterial-pest control products and the availability for adequate tested blast water (bacterial-*Salmonella*) should also be discussed with the customer and his veterinarian.

A contractor entering the egg, broiler and chicken stock breeding industry does best (Fig. 1.2) when it is understood that he intends to operate within the food manufacturing industry (animal to food), which also encompasses FDA, EPA and OSHA guidelines. Due to the multitude of encountered applications, jobsites, human and animal conditions, a standardization of a biosecurity program in "one size fits all" cannot be established (Fig. 1.3). Most bird infections-pathogens-salmonella or respiratory diseases can be spread by multiple incoming or outgoing routes. The biosecurity program will include standard operational procedures (embracing food safety guidelines) to eliminate the risk of exposure to organisms,

Fig. 1.3 Cattle feeder unit

Fig. 1.4 Grain and feed silos

therefore protecting animal health. A constant review-updating process identifying and prioritizing the potential sources between, during and after facility visits and designing adequate application techniques is vital to the program. Further, it is only of value in written form, and treated equal to a job-bid report, when signed off by all involved to gain legitimacy. Contractors must also guarantee that equipment is sterilized, warranting no possible cross-contamination from neighboring farms, their herds, equipment, or prior job sites. As veterinarians sterilize-sanitize themselves between farm visits, so must also be the contractor's crew and their equipment.

The service provider may also encounter mandatory quarantine restriction periods (3–7 days) between visitations to primary flock breeding facilities, a minimum of 4–5 weeks for bird houses, and 6–7 weeks for laying houses.

Needless to say, technical capability and versatility in applying pesticides and disinfectants correctly during an application processes is mission critical and must be verifiable. No producer or exhibitor is willing to put thousands of animals at risk due to contractor's negligence or incompetence.

Once flock replacement schedules are confirmed, facilities clean out schedule and necessary maintenance procedure is established in written form. Contractors may offer interior or exterior cleaning and pest-bacterial control measures on concrete floors, plastic curtains, ceilings, walls, feeders, drinkers, feed drums and all other production equipment (Fig. 1.4). This includes cleaning and

Fig. 1.5 Wastewater recovery shoe

decontaminating-sanitizing flock placement vehicles, feed container silos (Fig. 1.5) water supply equipment, etc. Once on-site and cleaning operations are in progress it is important to work closely with flock supervisors and laboratory personnel (veterinarian) that will evaluate and perform bacterial counts on cleaned areas to determine a "passing" status before restocking.

Cleaning schedules in hog operations, furrowing and finishing houses may provide a one to four day window in their production cycles. Zoos and safari parks provide cleaning schedules during fall and winter seasons.

Aquariums, kennels and racetracks may offer contracting possibilities, seasonal, biannual or annually. In these environments, offering an established biosecurity program integrated to contractor's application varieties will greatly enhance business opportunities. Most operations own in-house hot or cold pressure washing equipment, performing at 1–3,000 psi, 1.5–5 gpm. The available application range (90%) to the contractor requires between 3 and 8,000 psi at 5 to 35 gpm, hot water 200° Fahrenheit plus and/or cold water equipment.

In slurrifying or dredging organic waste, cleaning and sanitizing, decontaminating or sterilizing, the contractor must streamline his hydro-tool variety to the application encountered and may require the following:

On demand chemical metering accessories (Fig. 1.1), dehumidifying equipment, hydro vacuum-dredging tools (Fig. 1.5) that are often fitted to a vacuum box; for flat work spin jet equipment with vacuum support, foam nozzles and rotary nozzles; manual or exterior automated tank cleaning equipment, sewer and pipe cleaning nozzles, water-filtration-recycling equipment and/or water abrasive blast gear.

Due to ambient temperature conditions (Fig. 1.6) and possible atomizing water jets in agricultural application environments (misting), equipment operator's pressure-washing or hydro-blasting in confined agricultural areas quite typically experience visibility problems. The possible creation of barn, silo or tank fog within an otherwise routine cleaning application must always be considered.

Fig. 1.6 Milk parlor

According to the specific application, adequate ventilation and/or dehumidifying equipment will therefore be considered.

Some applications encounter methane gas environments or chemical-burn-fire-explosion hazards demanding safety procedures to protect structures and involved personnel (pulverized or pressurize-humid grain-organic products). Major applications include: Cleaning grain elevators, feed mill equipment, silos and flour bins, harvesting machinery, vessels, including dredging sedimentation ponds, regenerating water wells and preparing wooden fencing, decks or buildings for staining and/or painting applications.

Most high-pressure water cleaning applications may also be offered or are an intricate part to production in orchard, potato, rice, soybean, tobacco including catfish fish farming environments. When out there in God's country, one must never underestimate the variety of products manufactured. Alfalfa grass is not only used for feed, but also converted into nutritional supplements or added to pharmaceutical products. The sugar cane-root harvest season promotes the seasonal business in sugar refineries.

These plants are also often found in sugar beet growing areas as are fuel (ethanol) and power producers, utilizing agricultural product and waste products (Fig. 1.7).

Grain production, their mills (Figs. 1.8, 1.9), storage facilities, rail and truck transportation equipment must also be considered. Farming cooperatives may service their equipment in large machine shop facilities in need of periodic cleaning services. There are many opportunities to justify activity in the agricultural environment.

Veterinarians and red meat producers may disagree on the best practices for pest or bacteria control procedures. Some prefer the chemical method, others the hot water method or a combination of both. Therefore, applying higher pressures with hot water at 200° plus Fahrenheit and up to 9,000 psi, deep cleaning cracks, bug

Fig. 1.7 Feed silos and loading facilities

Fig. 1.8 Grain silos

Fig. 1.9 Cattle feeder

holes and fissures in concrete slabs applying pesticides, killing pest eggs, larvae and bacteria should be sufficient in convincing either veterinarian or producer.

Further applications include: Coating-paint removal on steel or concrete surfaces in aquariums, sedimentation vessels, pools of all types, animal exhibition and holding areas; Cleaning and treating pedestrian areas, fountains, ponds and public exhibitions;

Decontaminating, cleaning, restoring aluminum or stainless steel equipment, tractor trailers, tanks, etc. with acid treatments; Sterilizing and sanitizing animal operating rooms, recuperating cells, and holding areas; Routinely sterilizing, sanitizing and treating production equipment in poultry hatcheries, cattle and hog facilities.

Contacts. Your local veterinarians and associations, avian contract breeders, zoo curators, purchasing and maintenance superintendents, dog pounds and kennels, breeders and farmers, truckers and feed lot operators (Fig. 1.10), dog and horse racing facilities.

Resources. Equipment and materials; WJTA, PNA, CETA, SSPC.

On the Internet. Veterinary associations, farmers and livestock cooperatives. Principles of disease prevention in commercial broiler integrated operations. Research requirements for biosecurity, cleaning or decontamination-disinfecting poultry equipment and housing; contact the American Association of Avian Pathologists, University of Pennsylvania.

Safety. *On the Internet*. Research sanitation performance standards compliance guide, FSIS-USDA best practices for equipment maintenance by pressure washing, http://www.cfsan.fda.gov/~lrd/hccp.html, Competency in agricultural hygiene. Safety procedures vary, depending on application and may include establishing confined space entry procedures, air monitoring devices, electrical or mechanical equipment lockout procedures. Establishing a step in/out area, where disinfectants are applied to boots, protective clothing and tools, or an all in/out decontamination procedure. A multitude of industrial safety regulations may be required.

APPLICATION REVIEW

Customer, Company: Da Web site: e-mail:		Date: Nr: Address: City: State: P.O. Box: ZIP Code:	
Purchasing	Engineering	Maintenance	Safety
Tel: e-mail:	Tel: e-mail:	Tel: e-mail:	Tel: e-mail:
Job Description:			
Job Location:	Job Site Risk Assessment:		Specify:
Job Site Review:			
Safety equipment and procedures: ©			
Concrete cleaning, feeders, tanks, production equipment, silos.			

WORKSHEET- PURCHASING - SALES

Fig. 1.10 Tar-pitch-product facilities

1.2 Asphalt-Tar-Mastics Industries, Bituminous Compound Manufacturers, Solvents, Emulsions, Adhesives Environment

In the mid 1950s, plant maintenance personnel invited Wolfgang Maasberg Sr., founder of WOMA corp., to design and develop specific tooling for coal producers' hardware, taking into consideration the difficulty of cleaning tar-pitch-product and treatment facilities (Fig. 1.10). Supported by the pump's quick-exchange plunger capability in manipulating the crucial gpm–psi ranges deemed necessary for product cutting or scaling applications, Otto Teufer, a WOMA employee who was considered a bona fide high-pressure water application technician in the developing Hydro-blast market designed an array of nozzles, lance-flex-lance equipment and combined them with tank and pipe cleaning techniques, applying 7,000 psi at various gpm-hp ranges. It was obvious to all involved that his discipline and work ethic as a submarine captain during World War II had given him great insight and intuition to correctly develop high-pressure water tooling. This in particular where the visual performance confirmation of a nozzle pattern, water-jet product penetration and tool interaction with scaled refuse manipulated in a confined space (sewers, pipes, flue-exhaust duct, etc.) was unknown or technically–physically not manageable. The ingenuity of Otto's techniques are today utilized by service providers with sophisticated equipment or application methods and are still steadily employed by asphalt emulsion-solvent manufacturers, bituminous roofing, vinyl flooring production facilities, coating manufacturers, asphalt recycling plants and asphalt paper-felt manufacturing processes only to name a few. He also constantly stressed that in an emerging hydro-blast market, manufacturing processes-technology-hardware and possible fouled product characteristics must be understood before a correct hydro-tool selection, safety procedures and necessary supplies could determine a successful

Fig. 1.11 Refinery

Fig. 1.12 Gravel mill for asphalt-concrete

job completion. Regardless of previous successful cleaning or scaling methods, tooling and pump fluids applied (water–emulsions–oils) the behavioral product characteristics of bituminous, viscous-sticky products such as tar, pitch, bunker seed or liquid mastics must always be taken anew into consideration.

Tar is derived by the destructive distillation of coal or the cracking process of petroleum (refineries Fig. 1.11). Straight run asphalts are distillates resulting from the evaporation of the volatile constituents of crude oil in a vacuum in the presence of steam. The further the distillation is carried, the harder the product. Blown asphalts are produced by blowing air through soft asphalt or heavy bituminous oil at high temperatures. These asphalts have a higher softening point, lower ductility and are less affected by temperature than comparably hard straight run asphalts. Emulsified asphalts are emulsions of asphalt cement and water that contain a small amount of an emulsifying agent. Cut back asphalts are asphalt cements that have been liquefied through blending with petroleum solvents. They are used as binding agents in cold mixed asphalt-concrete or as a penetrating prime coat surface treatment applied, for instance, on water dams, bridge or building foundations. The industry provides five penetration grades indicating the hardness of asphalt cement (Fig. 1.12) before mixing and at surface temperature; AC. original viscosity, AR. viscosity after hot mixing (40–50, 60–70, 85–100, 125–150 and 200–300).

Fig. 1.13 Asphalt plant

Penetration and adhesion parameters of asphalts or coatings must be known when cleaning procedures are defined. Porous, cleaned or reconstituted surfaces (anchor profile) which receive a new product or coating system should preferably receive a compatible product, producing and guaranteeing correct adhesion effectiveness.

The contract cleaner servicing a tar manufacturer's distillers, tanks, heaters, condensers, pipe systems or their containment areas should consider the vast array of products manufactured elsewhere utilizing tar in one form or another. To name a few corporate identities; Weather-control-protection-roofing products, irrigation pipes, insulation foils, pavers, adhesives-mastics, and paint-coating manufacturers. These can be serviced applying the existing knowledge base and equipment-tool variety.

Removing asphalt residue or tar appearing in bulk (Fig. 1.13) or thin layers has in the past been achieved by vacuum, steam, chemical cleaning or sandblast methods. Heated product behavior can be quite controversial when attempting to achieve the desired cleaning objectives. Steam composed of heated water/air droplets in a highly compressed stage leaving the nozzle orifice will create an ultra-high velocity when expanding into the atmosphere, thereby diminishing the mechanical energy rapidly by becoming a compressible blast medium. This process will not allow efficient bulk product removal above 1/8 in. Asphalt products softened by heat will move and generally then again adhere to surfaces yet to be penetrated by heat and steam velocity. This situation can be frustrating. Some contractors will apply chemical agents or emulsifiers to lubricate loose material in an effort to eliminate cleaning surfaces twice, creating quite a mess. The Hydro advantage is relatively low water compressibility, at approximately 0.5% at 10,000 psi, allowing a great nozzle standoff distance to the material being removed with minimal mechanical energy loss, moving the bulk material quickly and in a comparatively controlled fashion. Against popular belief, viscous tar, bituminous or bunker-seed products can be removed, pumped and emulsified with much higher efficiency than generally known by applying either water or emulsifying agents as the pump fluid medium. This is noticeable especially when the application is combined with a Hydrovac system operating in dry mode, removing the material from the jobsite.

Fig. 1.14 Asphalt-gravel chute

Abrasive blast techniques are successful in removing thin layered asphalt, tar and mastic products (Fig. 1.14). The sandblast system's energy can be transmitted to the product and surfaces quite well. Air velocity will accelerate the abrasives extremely high, creating a better nozzle standoff distance compared to steam systems. However, the problems are evident. Continually adding blast material to the product is considered undesirable as this will increase overall volume, removal and transportation costs.

Adding a porous profile (Fig. 1.15), especially where soiling reoccurs, will certainly hamper future cleaning attempts. When porous base surfaces are present (anchor profile), sandblast, steam or chemical techniques are slow and cumbersome while hydro-blasting, pressure washing procedures surpass and excel in time management, equipment mobilization and environmental protection. At times, on an existing structure where an anchor profile must be added or reestablished, hydro-blast and abrasive blast techniques (air-slurry-water-abrasive) are combined, preparing base surfaces for future coating procedures.

There are also some applications where ice blasting techniques can be employed in a stepped combination with high-pressure water (2,000–3,000 psi) producing accelerated bulk removal times due to the products low temperature (coal-tar-mastics). Recently developed industrial ice blasting equipment is in its infancy, but promising, especially where distances between equipment and jobsites (trigger gun operator) could exceed 50'. Establishing a controlled, measurable or adequate anchor profile for most coating applications is limited.

Contractors apply high-pressure water to clean or prepare production facilities in asphalt stills, processing raw asphalt into a roof grade product or offer their services to companies converting glass and organic felt into asphalt-bituminous mats, insulating siding, coal tar emulsions, asphalt mastics or powder goods and to manufacturers of general construction and weather sealing products such as mineral asphalt-shingles etc. Services include cleaning heat exchangers, boilers, polymer tanks (Fig. 1.16), vacuum suction roles, flue systems, water treatment

Fig. 1.15 Asphalt plant loading tracks, heater and baghouse

Fig. 1.16 Asphalt polymer tanks

Fig. 1.17 Rock quarry sorting plant

facilities and so forth. Rock quarries producing gravel, sand or concrete may also manufacture asphalt-bituminous products utilized in (hot) road surfacing applications. These plants are open to hydro services in a multitude of environments-manufacturing hardware du to a great product variety manufactured combining the composition of oil or coal tar (Fig. 1.17).

General water pressures throughout this industry range from 3,000 to 20,000 psi at various gpm performances.

Fig. 1.18 Asphalt loading facility

Surface cleaning and surface preparation methods for re-installment of paint and coatings will provide an outstanding adhesion factor. Deep penetrating high-pressure water can prepare rock foundations, fissures, expansion joints, etc. Expert tool configuration permits surface preparations of soft underlay substrate such as rubber, plastic, wood and wallboard, or hard concrete and steel surfaces. Above and below grade, structural water proofing applications, architectural restoration and mold remediation are all business facets important to the pressure washing and hydro blasting contractor.

Contacts. Purchasing, maintenance superintendent in distribution facilities, municipalities, related trucking, transportation (Fig. 1.18). Asphalt-mastic-coating, waterproofing companies, restoration, demolition, quarries and construction industries, equipment rental companies etc.

Resources. Technical "SSPC–WJTA". Trade papers, bid and contracting information on specific job descriptions provided for contractors and subcontractors by corporate web sites.

National association of waterproofing and structural repair contractors, http://www.nawsrc.org, Water-Proofing contractor Association, htpp://www.the waterproofers.org Bitumen Waterproofing Association, http://www.bwa-europe.com, Web info: "Asphalt-tar-mastics-manufacturing".

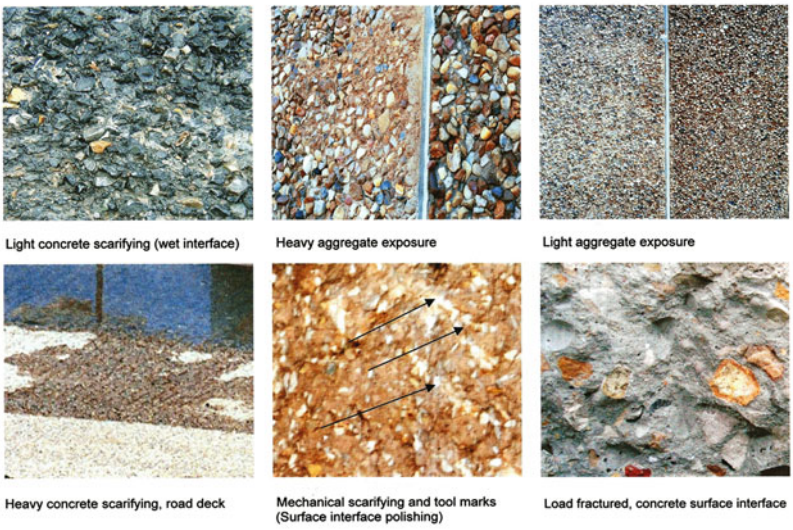
Safety requirements. Dependent on application, confined space entry permits, hazardous awareness training, competency in scaffold primary access (PAT), and supervisory competent person training (CPT). Hazardous waste management, EPA-OSHA-CWA-HUD compliance. Numerous applications frequently require a combination of controls.

APPLICATION REVIEW

Customer, Company: Web site: e-mail:		Date: Nr: Address: City: State: P.O. Box: ZIP Code:	
Purchasing	Engineering	Maintenance	Safety
Tel: e-mail: Area:	Tel: e-mail: Area:	Tel: e-mail: Area:	Tel: e-mail: Area:
Job Description:			
Job Location:	Job Site Risk Assessment:	Specify:	

Job Site Review:

Concrete scarifying and aggregate exposure.



Light concrete scarifying (wet interface) | Heavy aggregate exposure | Light aggregate exposure

Heavy concrete scarifying, road deck | Mechanical scarifying and tool marks (Surface interface polishing) | Load fractured, concrete surface interface

Safety equipment and procedures: ©

Tar and asphalt related production equipment, tower distiller, tanks, tub heaters or condensers, suction rolls, waterproofing, faults and fissures profiling.

WORKSHEET- PURCHASING - SALES

1.3 Automotive Manufacturers, Automotive Industries, Suppliers

Before World War II, the versatile industrial complex in the USA required high volume fluid transfer processes at comparatively elevated pressures (1,200 psi plus). Applying a massive horsepower input, Allis Chalmers, Gardner Denver, Ingersoll-Rand and F.E. Myers etc. provided the know-how and manufacturing capacity to develop and deliver enormous high-volume reciprocating pumps operating within their industrial environments. Necessary maintenance and cleaning cycles on in-plant hardware in these environments utilized a variety of mechanical and chemical cleaning procedures which starting in 1956 Europe were uncompromisingly displaced with tools manipulating high-pressure water. These tools replaced chemical circulation-purging and flushing methods, surface cleaning or product removal by steam cleaning equipment, rotary-flex lance brush and drill pipe operations servicing fouled boiler, condenser and heat-exchanger tubes. As water powered abrasive-blast equipment proved functional, rust, including paint-coating removal and establishing or reestablishing an anchor profile by applying air or electric driven needle-chisel-guns and in numerous industrial environment abrasive sandblast techniques were increasingly replaced or reduced to a supportive maintenance role (1959). Also, in light of the newly discovered application variety, Europe witnessed in the late 1950s, an accelerated hydro-blast equipment and tool development phase geared to Western, Mid and Far-Eastern industrial markets substantially surpassing technical development criteria and equipment sales in the United States. The introduction of high-pressure water in early 1960 as a cleaning, scale removal, abrasive-blast or vacuum tool proved cumbersome on US soil. Entrepreneurial efforts in the US converting the existing reciprocating pump equipment by reducing fluid volume and raising operating pressures to hydro-blast performances was the preferred norm and proved awkward. Also quite unexpected was the skepticism and disbelief in high-pressure water tool capabilities by plant maintenance personnel, competing service providers, pump manufacturers and engineering identities alike. Skepticism stubbornly prevailed into the mid 1960s. Surprising, as in the past high-pressure water already gained prominence in hydraulic mining procedures, steel slag removal-quench-methods, washing concrete slurry off newly poured structures on construction sites or applying low-volume pressurized water to clean in agricultural environments (Fig. 1.19), slaughterhouse facilities, pulp, paper and cardboard industries and servicing vehicle fleets.

In Germany mid 1956', founder Wolfgang Maasberg, WOMA Corp., in the early 1950s Paul Hammelmann, Hammelmann Corp. and Alfred Kärcher, Kärcher Corp., all three in somewhat similar positions after the war, believed in Wolfgang Maasberg's idea and concept "water as a tool". Alfred Kärcher repaired US military steam cleaning equipment which resulted in the development and manufacturing of Kärcher hot and cold pressure washing units and tooling.

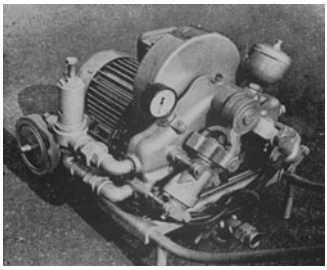


Fig. 1.19 Early twin piston pump

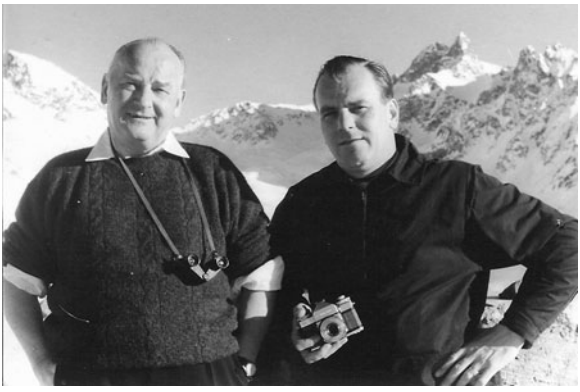


Fig. 1.20 Left, Oskar and Wolfgang Maasberg, Sen

Wolfgang Maasberg (Fig. 1.20), operating out of a car garage at his father's business Oscar Maasberg in Duisburg, sold to slaughterhouse operations and dairies the F.E. Myers reciprocating pump line, operating up to approximately 1,200 psi. To overcome the lack of applicable water pressure he then sometimes found it necessary to substitute or return to chemical cleaning methods. This led him to specifically design and manufacture the first hydro-blast pump series, (starting at 75–150 then 45 hp Fig. 1.21) founding as a result WOMA Corp.

At this time his pump design already featured quick exchange plunger configurations. The Pump head incorporated a manual pressure regulator permitting a gun-valve design, achieving the all important water shutoff capability operating above 5,000 psi.

Paul Hammelmann followed immediately by designing and improving available hydro-blast tool configurations converting his existing industrial Ruck-Zuck pump identity to hydro-blast equipment. Today Hammelmann Corp. is known worldwide and noted for their successful upright packing-less pump designs. In the US, George Rankin, founder of Aqua-Dyne, Houston, Texas, also a pump engineer and one of the first to develop hydro-blast pumps, gear and fluid ends within a comparatively compact design structure avoiding competitor's habits (US) to convert fluid transfer pumps to hydro-blast equipment.

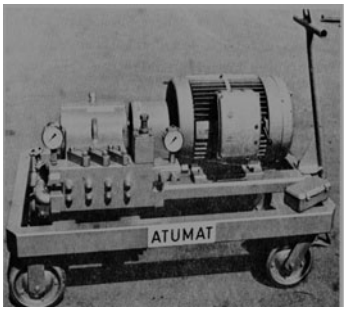


Fig. 1.21 75 hp, quick exchange plunger and pressure regulator

Fig. 1.22 43,000 psi Hp-gun

In the early 1970s, Flow Research of Renton, Washington was sponsored by the US government to develop hydraulic powered intensifiers, achieving water pressures of an astonishing 60,000 psi plus.

ADMAC, a partner of Flow Research, followed to develop and produce, in the USA, the first mobile contract cleaning, paint stripping and steel-concrete cutting UHP units. In-house stationary UHP pump intensifying equipment developed into two and three dimensional component cutting systems. These units incorporated abrasive or nonabrasive water jets in conjunction with NC, advanced CAD and robotic equipment and were integrated in a wide area of industrial manufacturing processes to enhance conventional product cutting methods. For instance, the equipment produces precision cut instrument panels, carpets, headliners, bumper parts and a multitude of composite component products. This is not to say that the automotive industry inspired engineers to develop equipment in the UHP pressure range.

Challenging application requests from the marine and industrial environment, application specific parameters, required tooling and operational effectiveness (efficiency), are the forces spurring high-pressure water tool designs (Fig. 1.22) and applicable pump pressures to 55,000 psi. Hydro-pump manufacturers (reciprocating) strive to achieve operating pressures at 55,000 psi plus, redefining tool development anew (hoses, nozzles, rotary seals, etc.) for service providers, equipment designers, and their customers.

Accommodating the car and industrial vehicle manufacturer, automated or manual service requirements seldom exceed 40,000 psi operating pressure. In their

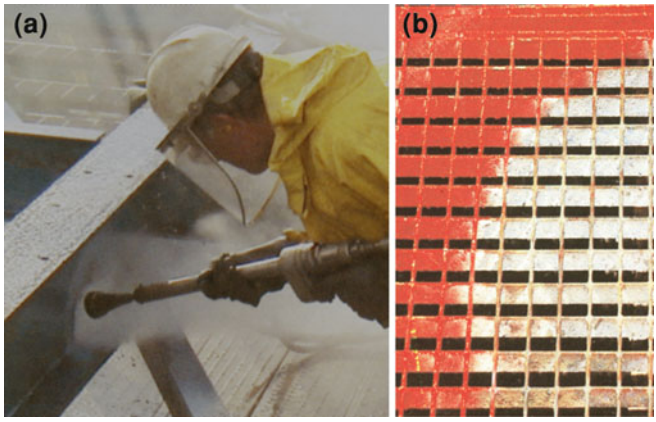


Fig. 1.23 **a**, **b** Coating removal

respective foundries, the global car manufacturing industry, starting with Mercedes, GM, Ford and VW began in the late 50s to experiment and clean their engine motor blocks. Casting sand and protruding metal flash were removed in oil and water passages with approximately 5,000 psi, at about 5 gpm. Ever since, high-pressure water cleaning applications have found their way into manufacturing environments, providing successful service solutions. In the early 1960s, as equipment durability and water pressures became adequate, the paint removal application expanded into automotive paint facilities (Fig. 1.23a, b).

Manufacturers, in their pursuit to apply superior paints to their products, benefit with today's available pressure–volume ranges and tool capabilities. Through the years, paint and coating development for impact and abrasion resistance, adhesion parameters and thermal durability in structure, led to a slow but constant rise in necessary water pressures regardless of a specific tool utilization or water volume configuration.

Combined with application specific tools, the UHP low water volume cleaning method offers a superior controllable product penetration. While in operation, comparatively lower tool recoil forces result in the laborer's extended physical endurance and safety. This permits the manual cleaning of vehicle transport equipment, paint booth surfaces and so on. Substantial flat work and grid-iron surfaces may also be cleaned with hand held or mobile spin jets. Contract cleaning companies offering their service capabilities to the automotive industry may approach their clients with a multifaceted sales strategy.

Most manufacturing plants have their in-house equipment and unionized labor force involved with specific turnaround schedules and maintenance procedures. The marketing strategy can, but should not be, based on turnaround schedules when streamlining an entrance to this field. Contractors do well in constantly educating maintenance engineers and purchasing identities in their specific areas, offering new application technology and equipment capabilities which cannot or

will not be challenged by the in-house labor force. Aggressive competitiveness, technical superiority, a close relationship with contractor's equipment engineering departments and a superior emergency response capacity will provide contract possibilities when in-house inoperable equipment, union strikes, a newly developed product line or manufacturing necessities arise. When all other business parameters, such as insurances, labor force status, equipment durability and accessibility is guaranteed, routinely upgraded and reviewed by customer's maintenance and purchasing department's, employment is plausible.

Contractors operating hydro-blast equipment offer in-house applications for automotive manufacturers to include: tank cleaning procedures, paint removal on grid flooring, paint spray booth surfaces, cleaning chassis transport units and their related manufacturing equipment.

Heating ducts and air-conditioning systems, bag house, flue-stack and heat exchanger or boiler services may also be offered in a subcontractor status to specific hardware suppliers and erectors.

Cleaning floor surfaces in machine shop and warehouse facilities with a minimum 20,000 square-foot per hour surface cleaning rate (36 hp plus), which includes the recycling of blast water, is also an important facet. Manufacturing and warehouse facilities' pipe-sewer systems, and followed by servicing the water treatment plant again is a further aspect one must consider.

Service providers operating hot or cold pressure washing equipment (3–5,000 psi.) clean the following:

Loading docks, industrial-commercial warehouse facilities, air-conditioning, heating and duct systems or equipment, in-house cafeterias, wash and change rooms. Smaller machine shops are cleaned by utilizing floor spin-jets with water filtration recycling and oil water separation equipment. This equipment can also be useful when cleaning parking lots and car garage structures or when providing chemical spill and storm cleanup services (Fig. 1.24 a–c). Tractor trailer fleets, cars for dealerships and vehicle rental companies, tractor trailer manufacturers, their engine and drive train repair facilities, trailer axle rebuild and service companies are all corporate identities to be considered.

Contact. Engineering, housekeeping, purchasing, maintenance superintendent for car truck-rental companies, engine-transmission-drive train rebuild operations, automotive part manufacturers, automotive paint shops, vehicle dealers, warehousing, vehicle shipping and trucking facilities, automotive foundry and metal works.

Resources. *Yellow Pages, Trade papers, Internet*. Automotive plant maintenance facility contracts through engineering, purchasing and maintenance superintendents. Automotive trade associations, such as AWDA the warehouse distributors association http://www.awda.org, or manufactures, distributors and dealers association and general automotive trade identities http://www.ashop.org, their machine shop facilities, purchasing and maintenance personnel.

Safety requirements. According to application encountered, combinations of controls are frequently required.

APPLICATION REVIEW

Customer, Company: Web site: e-mail:		Date: Nr: Address: City: State: P.O. Box: ZIP Code:	
Purchasing	Engineering	Maintenance	Safety
Tel: e-mail: Area:	Tel: e-mail: Area:	Tel: e-mail: Area:	Tel: e-mail: Area:
Job Description:			
Job Location:	Job Site Risk Assessment:		Specify:
Job Site Review:			
Safety equipment and procedures: ©			
Warehousing, trucking, loading docks, machine shops, paint shop facilities, chassis transport equipment, Garage structures and bag house units.			

WORKSHEET- PURCHASING - SALES

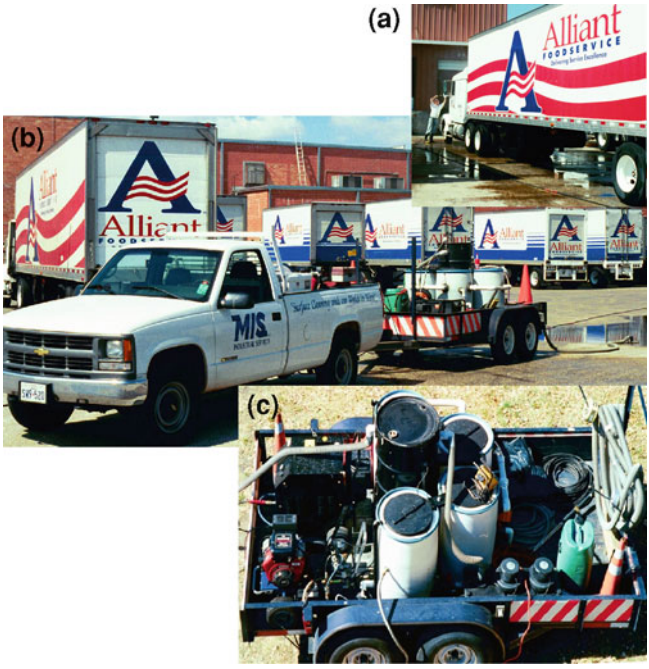


Fig. 1.24 **a–c** Fleet washing, water recovery-recycling

1.4 Airports, Aviation Industries and Their Municipalities, Suppliers

The aviation industry always offered a wide variety of flat work (horizontal), serviceable equipment, buildings and business identities. This fact accelerated in the early 1960s development of application possibilities which today contractors and equipment manufacturers do specialize in. Service companies do well when competing throughout the private, commercial and military aviation industry, applying pressure washing, hydro-blast and UHP technologies. Take into consideration the thousands of runways and landing pads within the continental USA and their subsequent necessary service support.

Pressure washing contractors clean private and commercial aircraft utilizing wash water recycling procedures, a variety of specialized tooling and polishing techniques to remove engine exhaust stains, oil and insect splatter from wing (Fig. 1.25), aircraft cowlings and discolored or soiled fuselage areas or the concentrate on servicing hangars, machine shops, freight facilities, restaurants and parking garage structures and their floors (Figs. 1.26, 1.27, 1.28).

Industrial hydro-blast services may remove rubber on runways, service b heat exchangers and chillers in air-conditioning and heating systems, clean lube oil and fuel tanks as well as removing industrial coatings on hangar floors and structures.

Fig. 1.25 **a–c** Wing surfaces

Fig. 1.26 Pedestrian areas-before

Fig. 1.27 Pedestrian area-safety cones

This environment also holds a vast application array within surrounding support businesses. Staying abreast of newly developed application varieties, subsequent tool and equipment changes, the aggressively changing technology provided by the pressure washing and hydro-blast manufacturing industry demands the constant education of purchasing agents, maintenance superintendents, contractors and their labor forces alike. Competition is stiff; therefore contract cleaners cannot sit back and wait for contracting opportunities provided by walk-in customer contact.

To gain experience in this field, smaller corporate service identities or entrepreneurs may pursue a subcontractor status with larger established companies. Approaching the industry's hardware suppliers, commercial building management identities, building contractors, their coating and painting companies may accelerate the learning curve substantially. A job specific superior hydro-tool variety enhancing productivity is also important to establish prominence within this field.

Service providers pursuing contracting bid status should research the FAA's (Federal Aviation Administration) compliance regulations when involved with aircraft or air carrier companies. They familiarize themselves with airport

Fig. 1.28 Pedestrian areas-after

authorities' runway maintenance schedules, requirements and guidelines, the proper containment and filtration or recycling practices of blast-wash-waste water today also established by airport authorities, city, state or the Environmental Protection Agency (EPA) and learn to comply with labor safety standards guided by the Occupational Health and Safety Administration (OSHA) (Fig. 1.28).

Providing adequate insurance is a business strategy amid a wide ranging price variance. A runway cleaning contractor will pay a substantial higher annual rate than the service provider cleaning airport parking structures. Due to the application variety, which may start with servicing airport restaurant kitchen exhausts (hood systems), airline catering food storage-manufacturing and receiving areas to rubber or coating removal on runways and in jet bridge areas renders the insurance question an important, sometimes decisive one for competing contractors.

Within the constant landing process of aircraft a tremendous mechanical friction between runway and aircraft tires results in a gradual rubber build-up, decreasing effective braking performance in adverse weather conditions. In the past this rubber build up was removed through a sandblasting process or chemical treatment. Needless to say this was inadequate.

In the mid 1960s WOMA Corp., West Germany, designed and developed a runway cleaning (test) unit operating between 150 and 600 hp. Much of their technical base knowledge applied then was derived from the manufacturing of street washing (Fig. 1.29) and sewer cleaning equipment sold throughout European municipalities. This street washing equipment operated in combination with a standard rotary brush supported by a curbside mounted vacuum shoe featuring a high-pressure water jet spray bar. A hydro vacuum injector (Hydrovac-system) delivered refuse and water to the onboard mounted water filtration recycling unit. This wash or blast water recycling capability is now a must for competing service providers.

In 1967, while cleaning and removing rubber build up on runway surfaces at NATO airports, such as the Husum air base near the Danish border, it became obvious that environmental changes, runway structure (Fig. 1.30) and surface friction coefficient, (asphalt-concrete-rubber) were not the only parameters for a correct cleaning and rubber removal solution by high-pressure water.

The following parameters were then established: Necessary pressure and water volume configurations on a multitude of runway (asphalt-concrete structures,) considering the multiple ambient temperatures and surface conditions, followed by adequate nozzle designs, their standoff distances, rigid and/or oscillating spray bar configurations, their width and horsepower requirements. Consolidating all

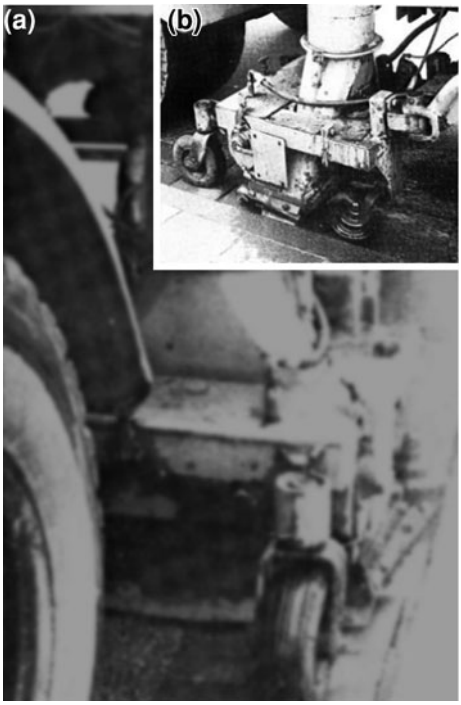


Fig. 1.29 **a–c** 1963 Street washing equipment

technical variables became measurable-recordable by outfitting the unit with a manually metered, onboard hydraulic drive system powered by PTO. The elimination of the driver clutch and gas pedal operation provided precise measurements in cleaning, rubber removal times and nozzle performance criteria while guarding against surface polishing or otherwise possible concrete or asphalt surface damage. Today, operational changes are obvious.

Pressure and volume configurations have altered due to technical developments, environmental considerations, runway design and surface testing procedures. Cleaning intervals are determined by aircraft weight, landing frequency, temperatures and general runway surface conditions. High traffic runways are generally serviced bi-annually. Airport maintenance may also resort to optical, physical, friction and texture testing procedures on the affected pavement before and after cleaning (mu-meter, grease- smear technique, ultrasonic thickness gauging). Coating or paint removal on taxiways and runways, Jet Bridge and plane parking areas (Fig. 1.31a, b) are next on the list of possibilities. Constant construction cycles and multitude of approaching aircraft types in service areas produce a necessary, quite lucrative and specialized field in itself. Epoxy coatings, plastics, bituminous paints found in the above-mentioned areas as well as in aircraft hangar's general aircraft production lines and paint facilities belong to this application group.

Blasting expansion joints clean of existing rubber or bituminous systems found on runways and taxiways can be achieved at any necessary width, depth or length.

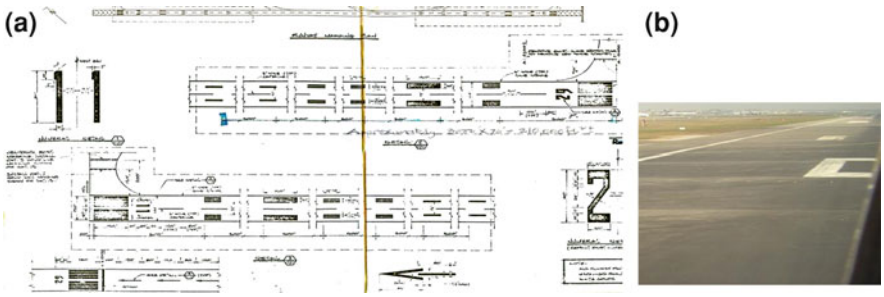


Fig. 1.30 **a**, **b** Runway layout

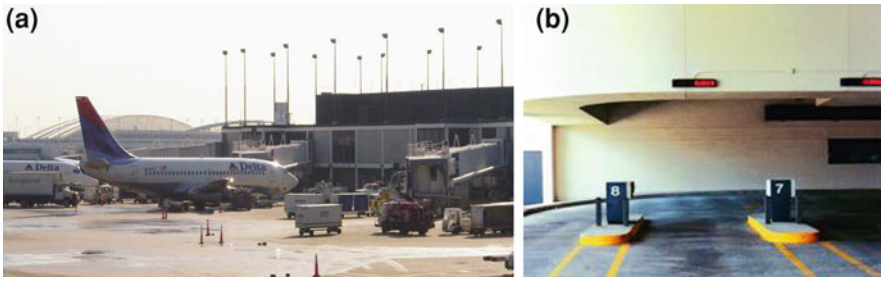


Fig. 1.31 **a**, **b** Jet bridge area

One must be cautious in determining why the need to do so arises. Maintenance operations vary extensively in their reasoning, due to changing weather, environmental conditions, normal-abnormal aircraft tire wear during the landing process, concrete surface and subsoil conditions including expansion joint service b history or general construction procedures.

Corrosion-rust accumulations removed by various high-pressure water blast techniques followed by chemically cleaning and painting or coating procedures in air conditioning, heating systems, vacuum ducts, tanks and pipes below or above ground can effectively be offered and performed as an competitive and save alternate solution.

Aircraft engine parts operating at extreme high temperatures are the most difficult to clean and strip of their soiling or coatings. Coating processes, materials, operating temperatures in their specific engine locations are parameters a UHP manufacturer considers when supplying automated equipment to the aviation industry. This field is quite specialized and does not directly compete with a contractors' business environment. Nevertheless, in some areas, developments in coating removal practices are applicable to the industrial field.

Cleaning an airports heating and air-conditioning system, their condensers and chillers (Fig. 1.32) or jet fuel and oil tanks including their pipeline systems are more or less industrial applications performed by experienced service companies.

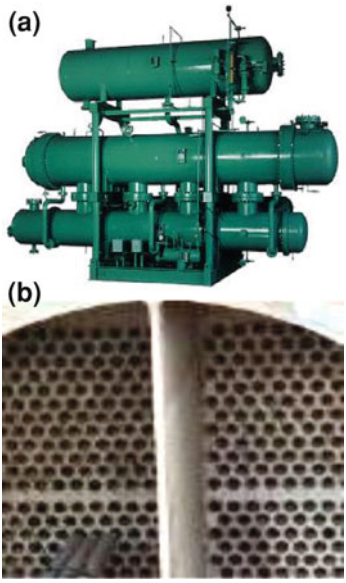


Fig. 1.32 **a**, **b** Condenser-sheet

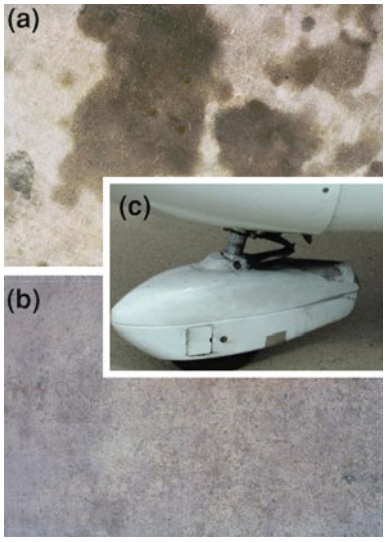


Fig. 1.33 **a–c** Before-after and source

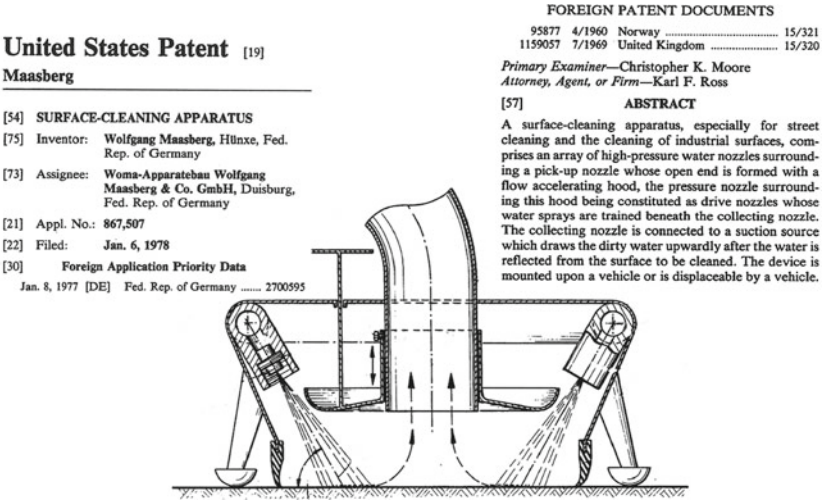
Airport parking-garage structures, airline catering and foodservice facilities, pedestrian and employee traffic locations, exterior building cleaning, truck loading docks, freight distribution centers, machine shops and so forth are applications providing great growth opportunities for the successful commercial pressure washing service company (Fig. 1.33).

1.4.18

APPLICATION REVIEW

Customer, Company:		Date: Nr:	
Web site: e-mail:		Address: City: State:	P.O. Box: ZIP Code:
Purchasing	Engineering	Maintenance	Safety
Tel: e-mail: Area:	Tel: e-mail: Area:	Tel: e-mail: Area:	Tel: e-mail: Area:
Job Description:			
Job Location:	Job Site Risk Assessment:		Specify:

Job Site Review:



United States Patent [19]

Maasberg

[54] **SURFACE-CLEANING APPARATUS**

[75] Inventor: **Wolfgang Maasberg**, Hünxe, Fed. Rep. of Germany

[73] Assignee: **Woma-Apparatebau Wolfgang Maasberg & Co. GmbH**, Duisburg, Fed. Rep. of Germany

[21] Appl. No.: **867,507**

[22] Filed: **Jan. 6, 1978**

[30] **Foreign Application Priority Data**

Jan. 8, 1977 [DE] Fed. Rep. of Germany 2700595

FOREIGN PATENT DOCUMENTS

95877 4/1960 Norway 15/321
1159057 7/1969 United Kingdom 15/320

Primary Examiner—Christopher K. Moore
Attorney, Agent, or Firm—Karl F. Ross

[57] **ABSTRACT**

A surface-cleaning apparatus, especially for street cleaning and the cleaning of industrial surfaces, comprises an array of high-pressure water nozzles surrounding a pick-up nozzle whose open end is formed with a flow accelerating hood, the pressure nozzle surrounding this hood being constituted as drive nozzles whose water sprays are trained beneath the collecting nozzle. The collecting nozzle is connected to a suction source which draws the dirty water upwardly after the water is reflected from the surface to be cleaned. The device is mounted upon a vehicle or is displaceable by a vehicle.

Fig. 129. c. 1963 Vacuum-jetting apparatus for mobile self-contained and water recycling street washing equipment, later converted for various surface cleaning applications including rubber removal,(second patent draft).

Safety equipment and procedures: ©

Expansion joint services, food catering facilities, warehouse services, epoxy and paint removal, concrete cutting, tank cleaning, sewer cleaning.

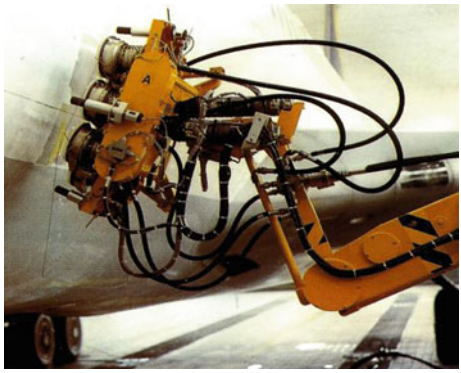


Fig. 1.34 Aircraft coating removal unit

A multitude of equipment is available operating at 3–55,000 psi with water volumes varying by applications encountered (Fig. 1.34). Water filtration and recycling units will greatly enhance contracting possibilities, especially when combined with a vacuum recycling capability, separating and isolating debris.

Achieving acceptability as a subcontractor with construction, restoration, industrial maintenance, and coating/paint companies is of vital interest to the new comer.

Contacts. On the Internet Airport Management Associations, Purchasing, engineering, maintenance through airport authorities, air carriers, includes air freight carriers, corporate fields for contracting policies and procedures, aviation insurance carriers, requesting vendor's application form for annual contracting opportunities and contact, Airport pavement maintenance management.

Resources. *Equipment-technical support*. WJTA–SSPC. General information; Air Transportation Association (ATA) offers an online database, aviation marketplace, also contact the Federal Aviation Administration's acquisition's policy and contracting departments, craft dealers, brokers and private clubs.

Safety requirements. Customers requirement, specific to applications encountered.

1.5 Battery Manufacturers, Recyclers, Suppliers, Process Equipment

Battery manufacturing and recycling processes and their chemical, plastics and metal suppliers are an obvious customer base for the industrial contractor. The major battery groups are nickel–cadmium, nickel–zinc, nickel–alkaline, nickel-metal-hydrate, lithium–ion and commercial or industrial lead acid deep-cycle batteries most commonly found in cars, boats, forklifts and the industrial environment. In the last 20 years a multitude of custom battery packs, lead acid

hybrids, rechargeable micro batteries were developed and are found in the computer, aviation, auto and medical environments.

The recycling process starts by the removal of combustible materials such as plastics. Plastics are melted and forced through an extruder, producing pellets for reuse in the battery manufacturing process. Separating plates, alloys and acids are the next step. Lead parts and lead oxides are melted in smelting furnaces producing ingots at 65 pounds, or hogs at 2000 pounds. This lead again is recycled for the manufacturing of new batteries. Acids are either processed or converted into sodium sulfate which is applied in detergents, glass and textile manufacturing or neutralized with a baking soda like compound, resulting in treatable water which is then restored to clean water standards.

The variety of base products found in the battery manufacturing and recycling process are plastics-polypropylene-vinyl, polymers, carbon graphite, nitric acids, sulfuric acid converted to hydrochloric acid, lead–lead oxides, nickel hydrate, zinc, lithium, titanium, platinum alloys and an array of insulation materials. Considering all these battery components, it is obvious that the industry is highly regulated by local, state and federal agencies which inspect manufacturing and recycling plants periodically to verify the compliance to required standards.

Contractors and service providers research this environment and do best by obtaining all necessary permits and licenses to adequately perform and promote their business possibilities. Gaining knowledge in industrial lead abatement procedures, labor hygiene, air filtration and clean air work practices is of significance, as is the awareness of technical or circumstantial fugitive potential lead emissions. For instance this may include poorly cleaned and dried surfaces introduced to air turbulence or cross winds resulting in unacceptable air lead contamination. A contractor and customer may be surprised that past cleaning efforts were only visually successful. Other lead dust sources can include dry sweeping, deferral-suspension by water mist, fumes, and burning. Also, when providing mobile vacuum, water filtration and recycling equipment procedures the components such as carbon, phosphoric or otherwise filtration (HPAC) systems must operate within regulatory standards. Competent contractors provide proof of equipment capabilities, which can result in laboratory test procedures sampling for contamination on equipment surfaces, collected effluent and air exhaust streams.

Submittal of federal-state licenses and the capability of adhering to customers' plant safety procedures are necessary in achieving a bid status. Manufacturing facilities and recycle plants install interior and exterior air monitoring equipment to provide verification as to the permissible airborne activity within regulatory laws guarding against potential lead overexposure.

Labor forces operating within these areas are informed in writing of the potential harmful effects when exposed to lead. Contaminated clothing cannot leave the jobsite and must be handled in accordance with company and OSHA regulations. The correct use of personal protective equipment (PPE) is imperative. Respiratory protection, positive or negative airflow situations are encountered and have to be correctly dealt with. In general, manufacturing plants submit and

enforce safety regulations vigorously and are supportive when contractors adhere to them, especially when in-house safety classes are provided to contracting forces. The contractor's labor force may also be required to produce certification from a blood lead laboratory prior to job or bid execution.

The entry-level entrepreneur will find this industry quite stimulating. He is advised to research EPA and OSHA requirements, and enrolls in necessary training courses to gain competency status through testing, acquiring hazardous material removal training and confined space entry procedure training.

It sounds more difficult than it actually is. The acquired education will help tremendously in choosing the right equipment and work method necessary to compete in this field.

Plant shutdown or turnaround schedules allow for the cleaning of the spent battery reclaim, repair, receiving, assembly, plate processing, oxide and grid production areas, followed by services to the plants environmental pollution control system as is the cleaning of under floor pipe ducting and filtration equipment, employee change rooms, truck loading docks, general storage facilities and the cleaning or preparation of concrete containment areas for coating procedures in areas where acid or chemicals are manipulated. The utilization of vacuum supported spin jets and water recycling/filtration systems are of great benefit. Industrial contractors also service battery crushing equipment, separation and desulphurization units, their piping and conveyor systems, tanks, water treatment facilities, sodium sulfate crystallization plant hardware, furnace flue gas heat exchangers, their piping and bag house systems, including rotary furnaces, crystallizer towers, hoppers, condensers and stacks, lead smelter equipment, wet and dry scrubbers and so forth.

Contacts. Purchasing Departments, maintenance superintendents, plant laboratory personnel, plant engineers in manufacturing, distribution, transportation, and recycling facilities.

Resources On the Internet "Battery council.org", "A–Z industry groups, associations and organizations". Battery recyclers waste prevention, storage-fuel cell, and battery engineering departments. "Battery manufacturers-processes-equipment". WJTA for equipment specifics, SSPC for supervisory and competent person training for "DELEADING of industrial structures".

Safety requirements. Hazardous waste management and awareness, EPA-OSHA-CWA regulations. OSHA provides an interactive web-based training tool on lead exposures in battery manufacturing environments, safety and health topics, http://www.osha.gov. In-plant training of specific corporate and plant safety requirements, respiratory protection and medical surveillance, identifying potential sources of exposure, Supervisory and competent person training (CPT). Many applications frequently require a combination of controls. Individual state laws may be more stringent than federal laws.

APPLICATION REVIEW

Customer, Company: Web site: e-mail:		Date: Nr: Address: City: State: P.O. Box: ZIP Code:	
Purchasing	Engineering	Maintenance	Safety
Tel: e-mail:	Tel: e-mail:	Tel: e-mail:	Tel: e-mail:
Job Description:			
Job Location:	Job Site Risk Assessment:		Specify:
Job Site Review:			
Safety equipment and procedures:			©
Receiving and pollution control areas, truck loading docks, condensers, heat exchangers, tanks, crystallization plant equipment, bag house units.			

1.6 Beverage Bottling Facilities, Breweries and Distilleries, Juice Processing

In this global industry at virtually every production level one will find successful application technology applied. The vast variety in product or produce converted into digestible liquid substances is unlimited. Service providers must study and understand the process and process equipment necessary to convert raw materials into finished products.

Raw material processing differentiates dramatically between product identities, seasonal schedules and is paralleled only occasionally in manufacturing, for instance within the bottling, packaging and shipping method. Plant layouts and manufacturing hardware also vary between product identities and age of the plant encountered.

Beer, wine and distillation processes have been with us for ages. This industry was one of the first to apply pressure washing and hydro-blast applications in the early to mid 50 s. Equipment manufacturers supply mobile and stationary equipment integrated into specific and continuous workflows, generating pressures from 1,500 to 5,000 psi, 180° plus hot or cold water, chemical metering devices applying suds-soaps, automated tank (Fig. 1.35) or barrel cleaning equipment and product recovery systems which include workstations with multiple gun operation capability situated on hotspots in the production line.

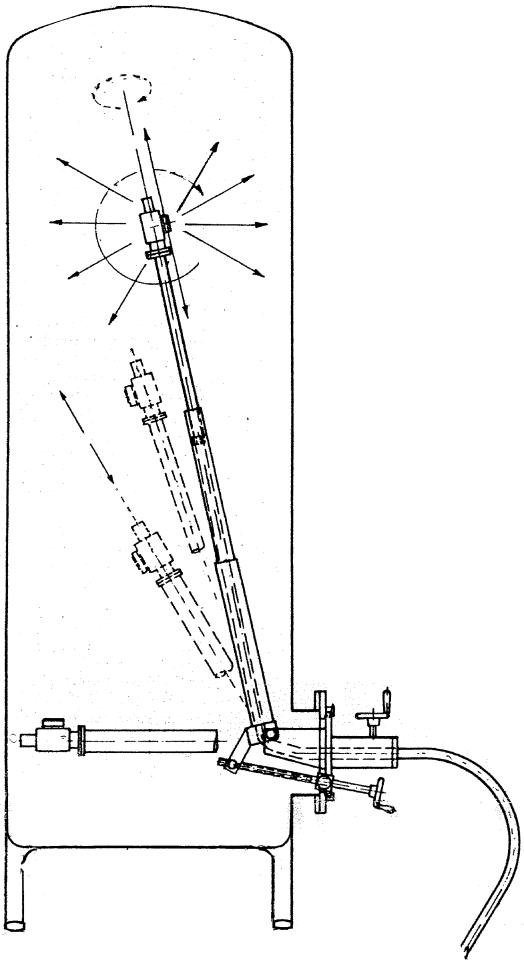


Fig. 1.35 Telescope fixture

In the last 35 years this industrial complex advanced enormously in plant automation, encompassing all production lines. In only one regard has nothing changed and that is expressed in producing continuous good and extremely taste neutral clean water. Companies may utilize two water supply systems for lesser and higher-quality potable water resulting in large water purification systems featuring filtration, reverse osmosis, boilers, heaters, condensers and evaporation units where periodic hydro blast services are necessary.

When production plants are located in remote regions where water access may be a problem and water conservation is a given, a coarse solid waste grouping of production materials and byproducts is performed utilizing cross filtration units, centrifugal separators, etc. The constant cleaning, sanitizing, sterilizing and pasteurization process and sometimes unavoidable occurrence of product spill

APPLICATION REVIEW

Customer, Company: Web site: e-mail:		Date: Nr: Address: City: State: P.O. Box: ZIP Code:	
Purchasing	Engineering	Maintenance	Safety
Tel: e-mail: Area:	Tel: e-mail: Area:	Tel: e-mail: Area:	Tel: e-mail: Area:
Job Description:			
Job Location:	Job Site Risk Assessment:	Specify:	
Job Site Review:  Fig. 1.36 3D Nozzle			
Safety equipment and procedures:			
Cooling tower, evaporators, fermentation tubes, refrigeration systems, cold storage facilities, tanker trucks,			

WORKSHEET- PURCHASING - SALES

Fig. 1.36 3D nozzle

requires large effluent treatment plants to control waste streams delivered by pipe systems, floor drain, pits and trenches.

This effluent, or better said, waste stream, must be chemically neutralized with a pH correction procedure in place to avoid overloading the treatment plant and its equipment, again providing hydro-blast and pressure washing applications. In any case, most companies are not permitted to incorporate the storm water system within their operation, demanding tight controls from in-house laboratory quality control managers, enforcing hazardous and critical point inspection procedures.

Byproducts may be separated, dried and milled supporting secondary product identities in medical, pharmaceutical or for instance in feed and fertilizer manufacturing operations. This provides the next layer of equipment services to be considered by contractors.

The service provider must assure his future customer that he is aware and understands that fruit, vegetable and grain processing, not only in the fermentation procedure, but also in manufacturing method, storage and transportation environments, may create a substantial safety hazard in oxygen deficiency, combustibility and toxic nature.

All industrial safety procedures may be encountered, including confined space entry, correct respiratory protection, egress methods, scaffolding, fall protection requirements, hardware lock out-take out procedures, and in plant safety-hygiene education just to mention a few.

The challenge is to plan and design an effective service agenda integrated with plant shutdowns individual maintenance schedules. This includes taking into consideration customer's hygiene and safety requirements, delivering a high degree of initiative to work within maintenance issues provided by maintenance planners, schedulers, maintenance superintendent and laboratory personnel (Fig. 1.36).

The pressure washing service provider has many opportunities, especially in smaller production facilities where processes may vary substantially from larger plants.

Services start with loading docks, trucking facilities, dry goods storage units, silos, refrigeration, cold storage facilities, maintenance machine shops utilizing water filtration and recycling equipment, cleaning corporate buildings and parking areas. Further, servicing equipment, hardware in fabrication-restoration locations (turn around yard), as in filter component, suction-roll equipment repair and cleaning procedures.

Professional behavior, incorporating and understanding safety requirements found in prospective environments, providing flexibility in service schedules and maintaining an educated labor force will set a contractor apart from others, creating opportunities for the future. Also consider that recently many microbreweries (Fig. 1.37) have established businesses in restaurant identities, permitting a multifaceted business strategy that introduces kitchen exhaust hood cleaning, general area and building cleaning procedures, including trucking and loading docks in the

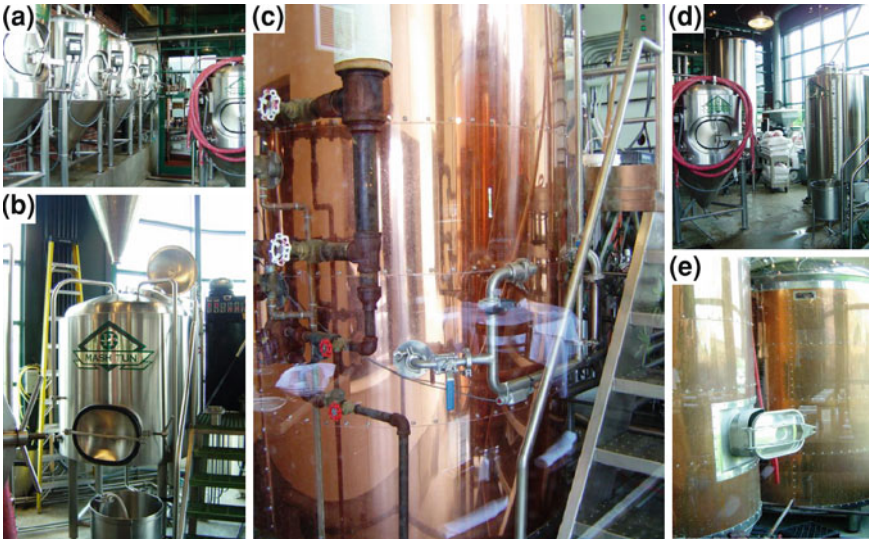


Fig. 1.37 **a–e** Various brewer vessels

food receiving location. Utilize hot or cold water with or without corrosion protective or sanitizing additives.

Specialized equipment may be necessary, such as automated tank cleaning equipment (Fig. 1.36), vacuum units, surface spin jets, vacuum assist water recycling and product recovery equipment, non marking food grade high-pressure hoses, disposable raingear, etc.

The manufacturer's environment, process, process knowledge, hygiene, sanitation and sterilization procedures must be studied, understood and followed.

Contacts. Purchasing, maintenance superintendents, engineering, brew masters, product laboratories, grain, sugar, fruit manufacturers, distilleries and wineries, frozen juice or soda pop manufacturers and their storage and transportation facilities. End-users such as microbreweries and restaurants.

Resources. Companies and product manufacturers by name, Internet resources, "Wineries, breweries, distilleries and juice processing companies", http://www.brewersadvocate.org. Area Yellow Pages, product and process specific trade papers, and their trade associations for instance. "Brewers Associations of America"

Safety requirements. USDA, FDA, EPA and OSHA requirements are enforced. Many applications frequently require a combination of controls. Individual State laws may be more stringent than federal laws and can be process oriented or a combination of.

APPLICATION REVIEW

Customer, Company: Web site: e-mail:		Date: Nr: Address: City: State: P.O. Box: ZIP Code:	
Purchasing	Engineering	Maintenance	Safety
Tel: e-mail: Area:	Tel: e-mail: Area:	Tel: e-mail: Area:	Tel: e-mail: Area:
Job Description:			
Job Location:	Job Site Risk Assessment:		Specify:
Job Site Review:			
Safety equipment and procedures: ©			
Hop strainers, incubating dryers, production settling and separation tanks, storage vessels, heat exchangers, boilers.			

WORKSHEET- PURCHASING - SALES

1.7 Butchers-Slaughterhouse Operations, General Processing, Cattle-Hog-Poultry, Animal Rendering

In the mid 1950s pressure-washing and hydro-blasting applications were successfully introduced to slaughterhouses-abattoirs, their meat processing facilities, animal rendering plants, storage, packaging and trucking identities. Today's equipment manufacturers provide in-plant units slated mainly for production oriented cleaning cycles (Fig. 1.38). As in the agricultural sector, controlled cleaning procedures, well executed sanitation programs concerning all machines, production rooms and manufacturing hardware are in place.

It is important that the service provider understands the slaughterhouse "code of good practices". This code will introduce him to all areas of importance.

Plant hardware and cleaning necessities may also vary between type of animal slaughtered and product manufactured. Daily volume of animals slaughtered is also a parameter to consider. One must reflect on specialty food manufacturers which may utilize carcasses in small numbers or large operations which slaughter and process in the hundreds, if not thousands of animals.

Slaughterhouse and production lines have a never ending consumption of steam, ice, cold/hot utility water or apply water regenerating plants for product manufacturing needs, creating application identities service providers should feel at home with.

Animal rendering facilities require another set of operational cleaning guidelines. They differentiate between the manufacturing of edible byproducts fit for human consumption and manufacturing of products such as fats, proteins, bone meal etc. utilized in animal feed, industrial applications, pharmaceutical and medical products. These facilities can be situated in remote locations or within the slaughterhouse environment and feature a wide variety of applications available to the service provider.

Obvious applications include the cleaning of condensers, heat exchangers, cooling towers, boilers and evaporators, stacks, bone mills, support equipment such as tanks, product conveyors, etc. The feed silos, animal holding areas and the livestock transportation environment can also be considered.

Permanent and itinerant personnel must be trained in in-plant operational and safety procedures. Contractors will seldom be offered a cleaning opportunity within the meat or product processing cycle. The principal in modern processing is that clean and unclean operations are efficiently separated. Contractors' personnel will not be permitted to enter clean areas during production cycles that start, in most companies, with the scalding/hair removal facility, inclusive of the poultry environment.

Manufacturers clean the following areas: Evisceration room, chilling and hanging facility (Fig. 1.39), cutting de-boning area, cooking and smoking, canning rooms, packaging, cold storage and freezer units which include delivery and dry storage facilities. Nowadays, most floor surfaces are concrete based, but one will find food grade nonporous tile as well as asphalt stabilized brick (Fig. 1.40).

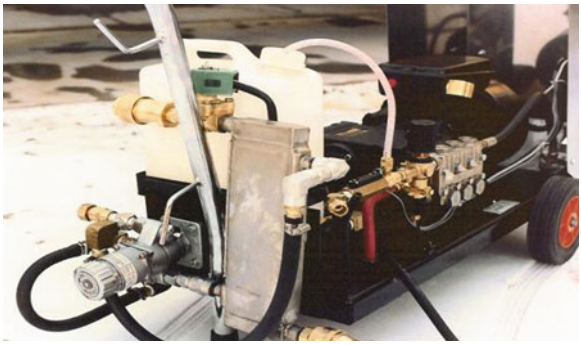


Fig. 1.38 Hot hp-water through heat-exchanger (steam)

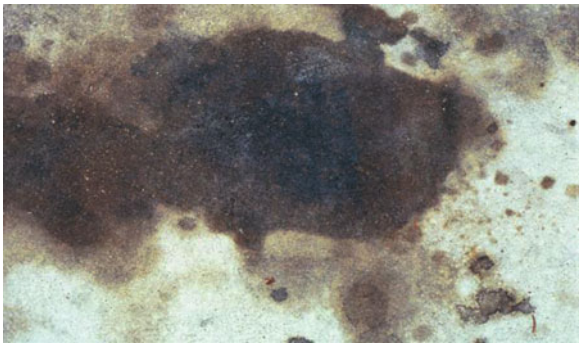


Fig. 1.39 Animal fat-blood removal before

Fig. 1.40 Animal fat-blood removal after

APPLICATION REVIEW

Customer, Company: Web site: e-mail:		Date: Nr: Address: City: State: P.O. Box: ZIP Code:	
Purchasing	Engineering	Maintenance	Safety
Tel: e-mail: Area:	Tel: e-mail: Area:	Tel: e-mail: Area:	Tel: e-mail: Area:
Job Description:			
Job Location:	Job Site Risk Assessment:		Specify:
Job Site Review:			
Safety equipment and procedures:			
Heat exchangers, boilers, cooling towers, kill floors, autoclaves, water treatment facility.			

WORKSHEET- PURCHASING - SALES

Due to the corrosive environment and hygiene requirements, most production equipment is manufactured from stainless steel, aluminum, food industry graded plastics and does not necessarily include plant hardware.

The service provider will deal with strong to medium alkaline detergents (sodium carbonate, sodium hydroxide), strong to medium acidic detergents (phosphoric acid, sulfuric acid) and anti-corrosive agents or inhibitors. When chemicals and disinfectants are used in a cleanup procedure it is recommended that the contractor finish his work cycle by thoroughly rinsing the entire area with water, then applying a water wash down under low-pressure with 200 ppm chlorine or otherwise recommended solution. Residue encountered on production floors, equipment and slaughter slabs include carbohydrates, sugars, fats, protein, salts, soy protein, glutei, amino acids found in animal tissue, etc., or a mixture of all. In house cleaning crews find that denatured proteins are very difficult to remove. Fat smear accumulations developed from proteins, mineral salts and other components turn into a wax like consistency and are often encountered in plant turnaround procedures.

A contractor must be qualified and adept to apply all necessary detergents, inhibitors and acids on demand. Plant maintenance and hygiene departments are most often the best information resource for these products. They will determine required solution ratios.

A prerequisit may exsist that the contractor's equipment or tooling is designed to operate under food manufacturing standards. High-pressure water hoses must be fat-acid resistant limiting hose streaking on floors which cannot be permitted. This includes providing boots, gloves, raingear and hair dress designed for this industry.

When working with a wand and/or hydro trigger gun, plant maintenance or inspectors may demand that over-spray or misting be eliminated (Fig. 1.41a, b, c). In this case, hand operated spin jets and surface floor units (Figs. 1.42, 1.43) with vacuum assist recycling and water filtration can be used. Due to waste encountered, the Hydro-vac method may be employed in grease pits, pipe and sewer cleaning and general product or waste recovery. 80% of work found in this environment will require 3–10,000 psi, at 5 to 35 gpm hot (200°F.+) or cold water.

Contacts. Slaughterhouses, poultries, their purchasing and maintenance superintendents, including management in processing and hygiene departments, refrigerated warehousing, distribution facilities, trucking and rail companies. Food safety consultants and inspectors may be of help.

Resources. Technical: WJTA–SSPC, USDA–FDA, Internet food safety links, butchers, poultry business directories and associations. Retail distribution trade associations, North American Meat Processors Association, Meat traders associations, specialty meat producers found in area Yellow Pages and on the Internet.

Safety. Sanitation performance standards and compliance, personal hygiene. USDA-FDA standards. Clean Water Act, OSHA regulations. Food processing plants operate under tight State and Federal regulatory controls. Step-in/out area procedures, lock-out/takeout procedures, Awareness in hazard analysis of critical

Fig. 1.41 **a**, **b**, **c** Surface cleaner

Fig. 1.42 Wastewater recovery

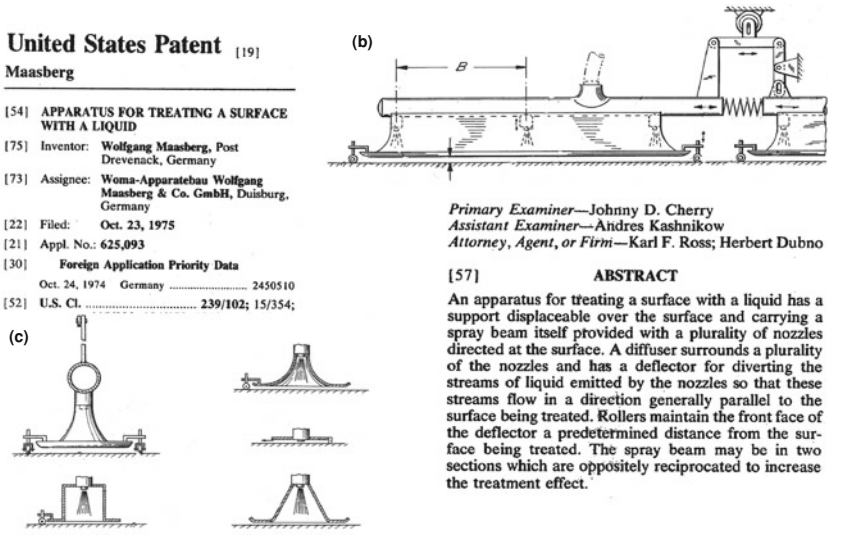
Fig. 1.43 Floating surface prep. equipment

control points in the manufacturing process are of an advantage (HAACP). Customers appreciate contractor awareness and compliance. Applications require a combination of controls.

APPLICATION REVIEW

Customer, Company:		Date: Nr:	
Web site: e-mail:		Address: City: State:	P.O. Box: ZIP Code:
Purchasing	Engineering	Maintenance	Safety
Tel: e-mail: Area:	Tel: e-mail: Area:	Tel: e-mail: Area:	Tel: e-mail: Area:
Job Description:			
Job Location:	Job Site Risk Assessment:		Specify:

Job Site Review:



United States Patent [19]

Maasberg

[54] **APPARATUS FOR TREATING A SURFACE WITH A LIQUID**

[75] Inventor: **Wolfgang Maasberg**, Post Drevenack, Germany

[73] Assignee: **Woma-Apparatebau Wolfgang Maasberg & Co. GmbH**, Duisburg, Germany

[22] Filed: **Oct. 23, 1975**

[21] Appl. No.: **625,093**

[30] **Foreign Application Priority Data**

Oct. 24, 1974 Germany 2450510

[52] U.S. Cl. 239/102; 15/354;

(b)

B

Primary Examiner—Johnny D. Cherry
Assistant Examiner—Andres Kashnikow
Attorney, Agent, or Firm—Karl F. Ross; Herbert Dubno

[57] **ABSTRACT**

An apparatus for treating a surface with a liquid has a support displaceable over the surface and carrying a spray beam itself provided with a plurality of nozzles directed at the surface. A diffuser surrounds a plurality of the nozzles and has a deflector for diverting the streams of liquid emitted by the nozzles so that these streams flow in a direction generally parallel to the surface being treated. Rollers maintain the front face of the deflector a predetermined distance from the surface being treated. The spray beam may be in two sections which are oppositely reciprocated to increase the treatment effect.

(c)

Fig. 1.41 b. c. Various jetting spray-bar configurations intended to reduce misting (fogging), also operated with mobile hydro-vac water recovery, filtration and recycling equipment. First patent draft 1964

Safety equipment and procedures: ©

Silos, loading docks, grease pits and pipes, product conveyors, tanks.

WORKSHEET- PURCHASING - SALES

1.8 Buildings, Washing Exterior–Interior, Surface Prep, Graffiti Removal Restoration, Waterproofing, Stone Care, Wood Care

The maintenance of properties generates a never ending application variety. The industry vigorously develops new tooling to support the demands in cleaning, maintaining or restoring high-rises, industrial-corporate buildings (Figs. 1.44–1.47), churches, monuments, hospitals, hotels, duplexes, rental and residential housing markets.

When considering today's available pressure washing and hydro tool configurations, combined with the industry's specialization in necessary support equipment to accommodate the forever changing job environment, experienced safety minded employees and subcontractors in their specific fields are essential.

Maintaining and developing the labor forces educational path in safe access, fall protection, jobsite safety procedures, behavioral habits', including achieving the all important awareness of how to apply hydro-tools in adverse job locations and conditions, is considered a cost of this business. In a bidding process, professionals strive to foresee the unknown, leaving nothing to chance and minimizing the results of possible customer suggestiveness or wishful thinking.

Meticulously recording all related job specifics will build and enhance an entrepreneurs' business identity. Service providers that record job successes and their shortcomings add to their overall classification and provide a certain amount of accountability and controllability in gathering corporate hands-on application knowledge. It also enhances management costing methods in application variety, flexibility and possible labor or equipment employment strategy.

The paperwork trail begins with the salespersons worksheet when visiting the future jobsite and ends with checking of the equipment gear-up list when returning to the yard after job completion. This is absolutely necessary to establish corporate statistics.

The job gear-up, break-down times must be estimated and may include scaffolding-tarpaulin-sidewalk canopy procedures.

Pedestrian-vehicle traffic control and the customers' working hours are considered when coordinating job access and performance schedules.

Applicable, hazardous waste identification, its removal, transportation, disposal, safety equipment, and essentials like duct-tape, signage and traffic cones are just some of the obvious costs to consider in the bidding process. Support equipment technical-legal status, practicality, availability and cost are established. Scaffolding and tarpaulin methods have developed exponentially, accommodating pressure washing and hydro blast methods not only in confinement, but also in load classifications, permitting loading of equipment to crash floors. Availability in labor access equipment has improved dramatically. Jobsite waste or product removal systems may be integrated into the work process.

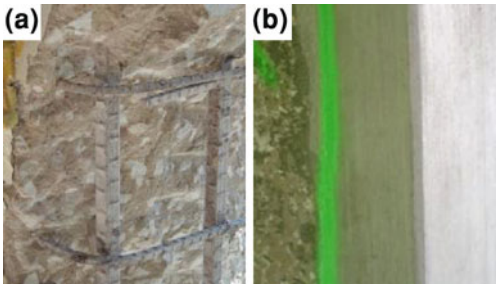


Fig. 1.44 **a**, **b** In-situ repair

Fig. 1.45 In-situ wall repair

Confined space, vacuum assist filtration and water recycling-debris separation equipment is today an equipment identity necessary for flat, vertical and overhead work in a multitude of situations.

Limited water access may also introduce filtration and water recycling equipment to the jobsite. These evolving technical application elements must be realized and studied as they represent the entrepreneurial vehicle to service providers, moving their potential into the commercial and industrial environment.

Future marketing strategy and completed job history is of utmost importance when deciding on equipment combinations or when to purchase them. Too often,

Fig. 1.46 Aggregate before

Fig. 1.47 Aggregate after

equipment, although powerful, is not flexible enough in mobility, tool utilization or requires too much water which may hamper filtration and water recycling efforts. It can also be assumed that the lack of application knowledge is visually identifiable when visiting a contractor's yard.

The need to work within EPA, OSHA, state, city regulatory laws and guidelines providing sound environmentally correct cleaning methods is not to be looked upon as a hindrance but as a generator in application specialization efforts. Service providers committed to do so create a vast variety in business opportunities.

When servicing the private sector, major applications include: Fire-disaster cleanup; Cleaning, disinfecting, sanitizing contaminated areas; Exterior–interior mildew, fungus, moss control and cleaning procedures; Removing masonry coatings, paints and surface deterioration to prepare for painting, water-proofing or

Fig. 1.48 Construction site cleaning

Fig. 1.49 Building restoration

construction needs; Removal of deposits such as concrete spatter (Fig. 1.48–1.50), graffiti and hydrocarbons, soot, fly-ash, loose paint, grease deposits, bird droppings and/or organic growth.

Starting out, the entrepreneur can consider roof and house washing applications, learning to protect the flower and foliage environment in his vicinity, masking possible openings and protecting windows, window frames, in particular when chemicals are applied, as well as cleaning, staining wooden structures, fences, terraces, concrete driveways and so forth.

When entrusting vital project decisions to a contractor, private home owners are quite suspicious, reluctant or simply nervous deciding on how to clean their home.

A beginner wishing to compete in the residential property cleaning application is best advised to study and research the general criteria building and façade inspectors utilize. Building inspectors' standard practices in building site access, periodic inspections of building façades for unsafe conditions, recognizing

Fig. 1.50 Building washing prior to tuck-point procedures

previous maintenance justifications, repairs, modifications and façades performance issues can help dramatically in correctly analyzing job necessities.

A vast variety in building designs and construction materials are encountered in the house washing application. Concrete, masonry, wood maintenance, paint and coating knowledge will further enhance the marketability to the home owner. To further their course, aggressive entrepreneurs may acquire experience, technical knowledge slowly incorporating building demolition-restoration and construction site cleanup procedures. Specializing in supporting high-profile restorations on buildings, monuments, including working on intricate, creative, and architecturally historic structures, providing cleaning methods designed not to damage or alter surface profiles encountered, and where expertise in a wide range of trades must be combined and coordinated with innovative pressure washing and hydro-blasting techniques. This can include offering the installation of bird control fixtures on exterior façades after cleaning and substrate treatment measures are completed.

To ensure a successful bidding process, application related preferable tool configuration must be explained and demonstrated in detail, as a practical solution to the available nondestructive pressure washing-hydro blast cleaning method. Conservationists, architects, chemists, structural engineers, construction superintendents, masons and carpenters alike will demand this attention to detail.

Cleaning the exterior of high-rises and monuments is not for the faint (everything above four floors) of heart or inexperienced. Restoration, building enhancement (Fig. 1.51) and water proofing needs are the most likely generator for a job-bid walk.

Close attention and cooperation in developing a job strategy between the customers' architect, trade contractors, scaffolding company and building-façade inspector is a requirement. A well insured and equipped service provider supplies a safety minded and where applicable, a licensed, educated labor force operating on swing stages, boatswain's chairs, scaffolding systems and access lifts.

Besides cleaning and water proofing applications, a contractor may be asked to perform a controlled hydro excavation of structural steel joints, rebar systems,

Fig. 1.51 Brick wall washing

Fig. 1.52 Brick patina before washing, after tuck-pointing

removing concrete, masonry structure, architectural stone on high-rise exteriors and interior surfaces.

The enlightened service provider, who maintains contracts cleaning sidewalks, drive-thru and parking areas for convenience stores, restaurants, banks, gas stations, hotels, office units and garage facilities is prudent to consider the

APPLICATION REVIEW

Customer, Company: Web site: e-mail:		Date: Nr: Address: City: State: P.O. Box: ZIP Code:	
Purchasing	Engineering	Maintenance	Safety
Tel: e-mail: Area:	Tel: e-mail: Area:	Tel: e-mail: Area:	Tel: e-mail: Area:
Job Description:	Job Site Risk Assessment:	Specify:	
Job Location:			

Jobsite Review:

Concrete interface prep:

Fig. 1.53 Abrasive-blast injector

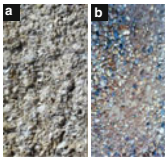


Fig.1.54 a.b. Concrete interface before-after

Fig. 1.55 Concrete form-boards

Fig. 1.56 restored balcony structure

Trade Related Publications:

6. Jonathan M. Whitt (1999) Power-washing 101, A manual for operating a residential and light commercial, pressure washing business, Advantage publishing company,
Little Rock Arkansas 72205-3823, Tel. 501-280-0007
http://www.adpub.com [6.28.406]
7. Master Painters Institute (2002) Maintenance Repainting Manual, by MPI, exterior systems evaluation, surface preparation,
http://www.mpi.net [6.28.406]

Safety equipment and procedures: ©

Pipe and sewer cleaning, high-rise laundry - garbage chute cleaning and disinfecting, sidewalks, oil-debris removal.

WORKSHEET- PURCHASING - SALES

Figs. 1.53–1.56

Fig. 1.57 10,000 ft^2 plus per hour flat-work

Fig. 1.58 Hydro-vacuum result while cleaning

commercial-industrial market as their equipment should be capable of performing in this environment.

Commercial buildings, their business identities and manufacturing processes offer the widest application range and growth opportunity to the service provider. Their businesses encompass most industrial cleaning procedures, facilitating and accelerating the contractor's necessary experience and confidence required when engaging the industrial environment.

Servicing the commercial sector, major applications are: Cleaning and surface preparations for painting-coating on masonry structures, cleaning production hardware, equipment and vessels, steel preparation facilitating painting-coating procedures in support of fabrication and/or maintenance work, providing 10,000 ft^2 plus per hour general surface cleaning capacities on manufacturing and warehouse flooring during vacation or maintenance turnaround schedule utilizing vacuum assist water recycling and filtration capabilities.

The contractor's professionalism in cleaning large exterior and interior surfaces may open the door to entertain a bid status supporting manufacturers' processes or routine equipment cleaning requirements (Fig. 1.52).

APPLICATION REVIEW

Customer, Company: Web site: e-mail:		Date: Nr: Address: City: State: P.O. Box: ZIP Code:	
Purchasing	Engineering	Maintenance	Safety
Tel: e-mail: Area:	Tel: e-mail: Area:	Tel: e-mail: Area:	Tel: e-mail: Area:
Job Description:	Job Site Risk Assessment:	Specify:	
Job Location:			

Jobsite Review:

Fig.1.59 a.b.c.d Bird repel system

A fixture to repel birds,
straightforward installation to susceptible building areas

Trade Related Publications:

3. Cyril Harris (1993) Dictionary of Architecture & Construction, McGraw-Hill, Inc., http://www.mhprofessional.com [6.28.406]

Safety equipment and procedures: ©

Graffiti removal, masonry coating removal, paint and coating removal, emergency spill remediation, aluminum siding.

WORKSHEET- PURCHASING - SALES

Fig. 1.59 a–d Bird repel system

1.8.1 Application Capacities

A. Washing exterior–interior surfaces including dust removal in high access cleaning procedures with effluent and debris recovery techniques employing the hydro-vac, filtration, water recycling or evaporation methods. An extensive surface variety is encountered. This equipment configuration can lead into criminal, accident and disaster clean-up opportunities, and is often overlooked by salesman prowling for business opportunities.
B. In combination with high-pressure water cleaning methods, employing water filtration, recycling and HEPA vacuum procedures, dehumidification equipment in mildew-spore and fungus remediation applications is considered a vital up-and-coming application. Due to application diversity, a high degree of knowledge must be gathered in how and why mold-fungus-spore-moss grows. Before finding an adequate remedy, a consultation with area chemists, building inspectors and possible coating specialists is advisable (Figs. 1.53–1.56)

Environmental conditions found indoors and or outdoors, such as dark and damp surroundings, poor ventilation, nourishment in construction materials, indoor environments with high transient humidity or structural microclimates and their favorable surface temperatures are obvious research points that remedies must be found for. Accidents and natural disasters are also generators of this application. Specializing in this field requires applying today's equipment correctly in combination with job specific support equipment and tooling. Job circumstances can lead into the hazardous material removal business as well.

C. Paint and coating removal on commercial, industrial structures applying environmentally correct cleaning methods, adhering to all necessary safety procedures, supervisory competent personnel implementing effective controls in paint-coating identification, if necessary, exposure control, environment monitoring, including product recovery and disposal. This application may evolve into lead or asbestos abatement practices, chemical spill clean-up and accidental product recovery procedures.
D. Demolition and restoration applications throughout the commercial environment. This is a facet with no limitations of specialization and growth. The water blasting specialist is capable of removing surface deposits from architectural sand stone without damaging or altering surface profile. He may clean and prepare wood structures for painting or staining procedures. High-pressure water can be applied to ready marble-granite slabs minimizing scarring or scratching by foreign objects in the polishing procedure, providing savings in time and materials. Wear vibration or surface damage by air hammer or other mechanical means is not acceptable; the demolition capability of high-pressure water may lead into restoration specialization of historical structures. When applying the non-destructive cleaning method in historical architectural restoration and preservation applications, the pressure washing and hydro-blasting

specialist is virtually indispensable. The investigative phase, deconstruction phase and desired preservation method is accommodated and supported by a wide variety of applicable tool configurations, including the hydro vacuum method (Fig. 1.57) with adjustable vacuum-airflow performances and job specific tooling (Fig. 1.58)

Contact. Purchasing, maintenance, engineering, housekeeping commercial and industrial business identities. Municipalities to receive funds from HUD for façade improvement programs and their published and detailed guidelines for businesses interested in participation of a bid status. Also building owners requiring funds for restoration CDBG, which are HUD funds.

Resources. Condominium associations, real estate holding and management companies, insurance companies, building and façade inspectors, architects, restoration, waterproofing and painting companies, Yellow Pages, Trade papers and consulting companies or the Internet.

Industry resources. WJTA, SSPC, PNA, IWCCI, ISSA, IICRC, ASTM E2270-03, Standard practice for periodic inspection of building façades for unsafe conditions. ASTM E06.55, Water leakage of building wall's. ASTM D5107-03, Preparatory surface cleaning of architectural sand stone.

Safety requirements. Hazardous awareness training, environmental compliance EPA, OSHA, and state regulations. Clean Water Act, Scaffold primary access training (PAT), http://www.scaffold.org, competent person training in applicable field (CPT), Traffic control laws and regulations, work zone-pedestrian-traffic safety regulations. SHAFACT Sheet, http://www.osha.gov (Fig. 1.59)

1.9 Commercial–Industrial Structures, Demolition-Rehab. Procedures, Construction Industries, Surface Preparation

The forever growing variety of dilapidated or deteriorating surfaces encountered on marine, commercial and industrial structures in need of rehabilitation, restoration or structural changes will expose the hydro-blast journeyman to a constant learning and seamless job recording process. Further more, customers and contractors estimating performance and time requirements will include surface roughness or anchor profile parameters, guaranteeing not only paint-coating adherence stipulated by manufacturers, engineers and coating inspectors but also an estimation of how much coating material is needed to achieve required strength or coating-liner thickness. Necessary tool selection, pressure and water volume configuration may vary substantially and must be chosen not only in accordance to scale or product removal requirements but must also be adapted to the jobsite, considering safety, effectiveness and accessibility when applying the hydro-tools.

Following are a few possible concerns that pressure washing and hydro-blast journeyman, service providers and their customers must consider:

Fig. 1.60 Gravel-aggregate before-after

1. Product-effluent removal and transfer procedures to the recycling and filtration unit, correctly installing supply and transfer hose systems maintaining work related mobility, which includes controlling and confining water-effluent run-off.
2. Correct identification, declaration, packaging and removal procedures to a licensed hazardous waste site.
3. Construction sites safe access requirements and their educational, procedural necessities. Engineering must provide scaffolding with correct structural weight classifications, in particular when equipment placement on crash floors and effluent transfer reservoirs are utilized.
4. Testing the job environment for possible contamination before, during and after job completion.
5. The correct placement of laborers break, shower, toilet, and staging facilities, establishing step in–out areas.
6. Traffic control and overall job-site security necessities.

These aspects are compounded and are rarely the same between jobsites. Pressure washing and hydro-blasting environments may be found underwater, between, below ground or at ground level in confined spaces and naturally, above ground locations situated at any imaginable height.

In the mid 1950s hydro-blast equipment manufacturers supplied and integrated the first units into concrete product manufacturing and process hardware services. Applications then concentrated on removing installed paper adhering to aggregate, controlling cement drying processes surrounding gravel material on pavers and prefab concrete slab modules intended to show open gravel-aggregate structures (Fig. 1.60). High-pressure water replaced the sandblast or brush technique. Soon thereafter plant maintenance personnel discovered an abundance of applications which spread throughout the entire Portland cement and concrete component manufacturing environment. In the mid 1960s high-pressure water extended cement kiln operating times with clinker removal procedures utilizing the thermal

Fig. 1.61 Rebar corrosion

Fig. 1.62 Concrete carbonation

shock method on clinker rings while the kiln rotated during production, minimizing Remington cannon shell usage and down times due to clinker build up. Much has since changed in the cement plant operating environment, rendering some of these application procedures to the past or elsewhere applied in industrial environments. In 1967 concrete scarifying, removal and demolition applications gained prominence both overseas as well as in the USA. Handheld and mobile equipment attained a level of dependability suitable for most facets of concrete cleaning and rehabilitation methods. This includes demolition applications on bridge decks, pylon structures, building façades and on a multitude of industrial structures. The equipment does not necessarily need to be purchased as it can be rented nationwide.

Engineers and contractors alike have gained valuable experience and are able to estimate performance schedules successfully. Damaged concrete structures are most often visually identifiable and submitted to physical failure analysis (Fig. 1.61). This involves laboratory testing prescribed by engineers and concrete specialists throughout the marine, industrial and commercial environment.

Basic test requirements include recording overall visible defects, including cracks, their length, width, depth, depth of concrete carbonation, presence of chlorides, chloride profiles, which include sulphate levels, concrete delaminating measurement in depth (Fig. 1.62) and area, degree of rebar reinforcement corrosion and existing efflorescence on concrete surfaces, possibly lime or salt deposits etc.

Before a removal procedure is described and submitted inspectors and engineers involved in nondestructive testing of concrete surfaces will resort to an array of available tooling and work methods. They may include concrete pull-off test procedures, core drill tests for moisture and saturation, determining the extent of

Fig. 1.63 Hydro concrete mill

structures internal damages by applying ultrasonic-pulse-impact-echo equipment and laboratory testing for chemical contamination status, etc.

The structure's environment and the chemical mechanism of concrete deterioration found is only one parameter necessary to establish a hydro-tool selection and work method. It is crucial to be correctly informed on the impending rehabilitation method and procedure to deliver a tool selection generating measurable adhesion parameters in surface roughness, desired porosity (anchor profile) and cleanliness to support new product installation and product warranty guidelines.

The rehabilitation process starts with the removal of deteriorated concrete material above and/or below the rebar structure, in the process neutralizing carbonation-salt-rust or acid damaged surfaces, checking periodically for surface roughness or anchor profile. This is done by utilizing a digital unit which provides the important readout. The contractor will establish cleaning and drying times of concrete structure before the painting-coating-liner resurfacing procedures commence.

The concrete scarifying method (Fig. 1.63) is also employed on new or existing structures where conversions, add-ons, load enhancement or coating and painting is required. Here again, a measurable surface treatment in porosity or surface roughness (anchor profile) is provided by the hydro technique, eliminating sand blasting, acid etching or mechanical equipment requirements.

Concrete bridge decks in need of an asphalt road deck installation may be prepared with a mobile hydro concrete mill. Aircraft hangars requiring a new coating system may utilize similar equipment, removing a partially measurable amount or a total removal of deteriorating coating when repairs are essential. Fish tanks, pools, fountains, concrete holding ponds and water tanks in need of coating procedures are all essential locations for the pressure washing, hydro-blasting and UHP service provider.

Coating removal practices on oil rigs, piers, water dams, their spillways, or steel–concrete bridges and water tanks require an educated, competent workforce. Access methods to these work sites are engineered by scaffold system manufacturers and rental companies of such equipment. With each access development, special attention must be given to environmental conditions, including prevention

Fig. 1.64 Vacu-coating removal

of overspray, denying a positive air pressure situation in confined work spaces, correctly assessing and engineering the scaffold systems life load qualifications. Scaffolding engineers must be made aware of incorporating water runoff containment and weight of effluent transfer units. At this time journeymen will decide on the necessary tool variety to access the surfaces in question. A scaffold designer will also incorporate all other necessities required by painters, welders, electricians, inspectors, etc. Needless to say, the complexity is staggering requiring engineering and practical experience. (CPT) All involved must provide certificates attesting to their capability in these specific areas. Hazardous waste removal experience is also a must, most likely a practice necessary within a job description to provide water recycling, filtration and decontamination capabilities.

To support the pressure washing, hydro-blasting-UHP journeyman the SSPC and NACE Society for Protective Coating and Corrosion established standards with a written and visual comparison. These visual guide references also provide a standard in evaluating the degree of rusting on painted steel surfaces depicted in general rusting, spot rusting and pinpoint rusting. Due to their visual comparison in cleanliness and surface conditions the standards are a great help in sales, engineering and application oriented endeavors. For the experienced, a guideline is established providing an approximate comparison when estimating a job by drawing from personal experience when comparing before and after with these references (photographs).

Paint and lead rich coating removal (Fig. 1.64) on elevated city water tanks also presents a prominent application, minimizing environmental concerns. The Hydro contractor will work in unison with painting contractors when a total removal of existing dilapidated coating system is necessary. Often, over coating procedures are desired, permitting a vacuum assist wash down utilizing approximately 4–12,000 psi. Pressure ranges in over coating procedures vary depending on paint conditions.

Throughout the chemical, oil, metal, food and produce manufacturing processes one will find secondary containment structures. The presences of destructive, aggressive or environmentally dangerous substances often accelerate the deterioration process on concrete and steel surfaces. These surface preparation needs and sheer business volume are often underestimated by pressure washing and hydro-blasting-UHP contractors. Surface treatment, demolition and scarifying methods are employed to facilitate relining, specialty coating, and hybrid concrete installation needs (Fig. 1.65).

Fig. 1.65 Manual coating removal

Fig. 1.66 Manual surface prep

For that matter, all construction sites are of interest to the entrepreneur, especially when a recycling and water filtration with refuse separation capability is available. Opportunities are plentiful. As always, there are facets where lesser experienced service providers may gain knowledge in a subcontracting status, for instance, by providing services to ready a site for inspectors and engineers in their preliminary investigation phase. The hydro demolition company preparing a deteriorating concrete structure in excavating the rebar system to ready the site for concrete gunning or "Shot Crete" applications may not be interested to perform the construction cleanup phase. Therefore, removing possible concrete overspray and spatter is another sub-contracting possibility (Fig. 1.66).

Contacts. On the Internet, "masonry associations", Rehabilitation, restoration and construction firms, their project managers, architects and field supervisors. Consider city engineering, waterproofing companies and painting contractors. Also inquire for service bids in cement, brick, masonry and structural cement component manufacturing plants. Many cement or masonry manufacturers will have their in-house equipment for specific application needs. This does not mean a service provider should ignore upcoming plant shutdowns and service schedules.

Resources. WJTA–SSPC. Internet, "national contractors" Bid and/or request for proposals generated by product manufacturers, architects, cities, housing projects, also all varieties of commercial contractors and property owners.

Safety. Specific requirements for subcontractor "construction safety", Construction site varieties, their locations, structural circumstances or processes demand a keen safety oriented perception and operational qualification. For information OSHA's A–Z index pages for construction safety, http://www.osha.gov. The Pressure washing, Hydro-blasting or UHP service provider must notice all necessary elements, not only for the important human safety aspect but also in providing a correct bidding process, taking into account all operational circumstances that may change during the contracting period. States, cities, or companies may require a contractor's license for specific jobs or in general.

APPLICATION REVIEW

Customer, Company: Web site: e-mail:		Date: Address: City: State:	Nr: P.O. Box:: ZIP Code:
Purchasing	Engineering	Maintenance	Safety
Tel: e-mail: Area:	Tel: e-mail: Area:	Tel: e-mail: Area:	Tel: e-mail: Area:
Job Description:	Job Site Risk Assessment:		Specify:
Job Location:			

Jobsite Review:

Concrete removal at 43.000 psi

Fig. 1.67 Concrete removal-demolition

Trade related publications:

1. Andreas W. Momber, (1998) Waterjet applications in Construction Engineering, by A.A. Balkema, Rotterdam, NL
http://www.balkema.nl [6.28.406-1]

2. ACI- American concrete Institute and, BRE, ICRI (2003) Concrete repair manuals volume 1 and 2 published jointly [6.28.406-2]
http://www.concrete.org (Fig.1.67) from Page 61

Safety equipment and procedures: ©

Concrete scarifying, under water surface prep, dike repair, bridge deck concrete demolition, water tank cleaning.

WORKSHEET- PURCHASING - SALES

Fig. 1.67

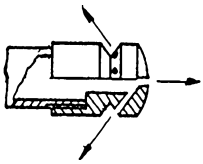


Fig. 1.68 Self-propelling nozzle

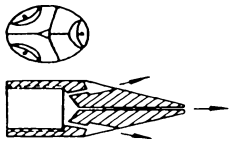


Fig. 1.69 Product cutting nozzles

Applications frequently demand a combination of controls, including a trained and licensed labor force, providing for instance, confined space entry permits, scaffold primary access training or supervisory and competent person training-certification in specific application environments. City, state and federal laws must be considered and applied. (EPA-OSHA-CWA, etc.)

1.10 Refinery-Oil-Polymer-Chemical Manufacturing Environments, Epoxy-Resin-Vinyl-Latex-Paint

The development of compact triplex pumps enabled commercial sewer cleaning professionals (1956) to apply the self propelling nozzle technology incorporating the necessary high-pressure hose assembly. This technology developed and patented by Wolfgang Maasberg Sr. enabled the cleaning of pipe and sewer systems in remote locations. The pumps compact design and comparatively low psi performance, (1,600 psi. plus) but high water volume output and a hydro-vacuum jet pump configuration, accelerated the development of truck and trailer mounted sewer-pipe cleaning equipment, featuring hydraulic operated hose reels, water-waste tanks, and so forth.

In Germany in the late 1950s to early 1960s, equipment manufacturer WOMA Corp. developed the 10,000 psi, approximately 22 gpm pump capacity utilizing 150 hp. air cooled diesel engines or stationary electric motors. This performance level facilitated the introduction of the tube-bundle cleaning method by high-pressure water.

The development of adequate nozzles (Fig. 1.68) and steel wire reinforced hoses, basically manufactured then for the oil-hydraulic environment, permitted the self propelling of flex lance assemblies throughout a condenser or liquid product transfer tube (pipes) with horsepower inputs and high-pressure-water volumes that were new to this era.

Product cutting nozzles (Fig. 1.69) were designed and employed on rigid steel lance assemblies wherever extensively fouled or solidly plugged tubes were

Fig. 1.70 Hydro-lance unit

encountered. The reaction and possible hydraulic forces developed by multiple nozzles pointing forward, concentrating the waters energy directly towards product and surrounding tube surfaces can be dangerous to a novice rigid lance operator. Product behavior and physical structure throughout a condenser or heat exchanger system may vary extensively. Hydraulic forces may develop, adding to already existing reaction forces upon the lance operator. When permitting product to collect behind the nozzle mount, then forming a seal between the tube wall and rigid lance body, can develop an explosive hydraulic piston situation towards the operator.

This cleaning practice is now more often semi-automatically performed (Fig. 1.70), avoiding the otherwise physically challenging and when incorrectly applied, dangerous product removal method for a hydro-lance operator. Depending on the product this may also occur with a flex lance operation when one forward jetting nozzle is, for instance, incorrectly sized or manipulated, penetrating too quickly through the product in question, possibly creating a hydraulic product piston, which reacts upon nozzle head surfaces thus blowing backwards towards the operator.

In the late 1950s to mid 1960s durability of hydro-blast equipment was marginal. V. packing, packing glands, O-rings, suction and pressure valves, piston-plunger configurations and their water sealing surfaces were subject to mechanical failure. Existing job reports of this period bear witness to the constant changing or replacement procedures of vital parts before, during, and after a job assignment. It was not only the pump's water and gear end side which needed consideration. High-pressure hoses adapted from the hydraulic environment were not suited in necessary durability and flexibility when applied to changing application varieties encountered.

Nozzle flow technology (Bernoulli theory), and metallurgy had to be studied and researched, taking into consideration the tremendous water velocities, necessary water cleanliness, filtration procedures and manufacturing methods. Operational stand times of pressure regulators, high-pressure guns, dump guns and rotating cleaning heads were also in their/or infancy and not very dependable. Engineers needed to understand metal stress parameters, packing glands and

Fig. 1.71 Hydro-cutting and demolition

O-ring installations, applying correct metallurgy and understanding cavitations influence on parts introduced to high pressure, high velocity water. In short, a never ending development and engineering process began.

Initially, cooperation and unified thinking habits between plant maintenance, engineering and purchasing allowed hydro manufacturers to design and further develop or test available and emerging technologies. Superior surface cleanliness, drastically reducing cleaning times, replacing costly alternative cleaning methods, such as employing rotary brush techniques, drilling and chemical cleaning procedures justified the engineering and development necessities to solve these mechanical weaknesses. Today's chemical, plastic and refinery environments will utilize pressures between 3,000 and 55,000 psi, with horsepower requirements ranging from 20 to 600 hp, determined by application necessary psi-water volume configuration.

In refineries 90% of the available job variety is performed between 4,000 and 35,000 psi and does include demolition work (Fig. 1.71). More often than not, they also operate in-house automated equipment like tube bundle cleaners and rotating hydro-coke drum cutters manipulated by a drill gantry structure.

Experienced hydro service providers classify the refineries available application variety more or less as a standard operational procedure, however, this cannot be assumed when servicing chemical and plastic processing hardware. The journeyman not only considers the arising and sometimes stringent safety requirements due to product encountered, but must also understand the product behavior when it is introduced to pressurized high velocity water and solvents. Necessary water volume and pressure configurations, combined with an expert tool selection may vary between job assignments due to product manufacturing processes. Products adhesion to surfaces and its tensile strength-elasticity-stickiness, systems process and operating temperature or void of, accidental product molecule changes due to manufacturing failure, or preparing hardware for product changeover requirements, to name just a few of the parameters considered, may alter cleaning and removal techniques greatly. If this would not be enough, the journeyman must also

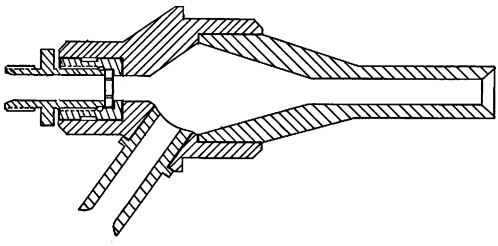


Fig. 1.72 Chemical-abrasive injector

be aware of cleanliness requirements which can be extreme. Generally, contractors do best when they understand that within the chemical and plastics environment, "clean" means cleaning to an absolute degree of cleanliness, eliminating all traces of prior existing residue. The final inspection process or method and inspection equipment applied by maintenance departments should be known to the journeyman, eliminating possible and nasty surprises before a job completion is recognized.

The newly developed UHP low water volume cleaning method offers, in combination with application specific tools, superior controllable product and corrosion penetration parameters. While in a cleaning operation, a lower tool reaction force generally developed by 2–3.5 gpm with a vacuum assist technology will remove debris and hot or cold water, benefiting the laborer's extended physical endurance and safety. Heated water and refuse is simply cooled utilizing a vacuum chill box, eliminating the need for long, high-temperature vacuum hose runs.

When incorporating the hydro-vac system, a secondary air cooling cycle may be provided to lower emerging temperatures to acceptable operating exhaust levels. If lead coating-asbestos removal procedures are encountered, an air filtration system (HEPA) may be of essence. This controlled cleaning or removal application technique of industrial coatings is therefore not only possible on large surfaces (remote vacuum assist equipment), but also in confined areas including corrosion removal on liquid transfer pipes, tanks of all designs and equipment protected by industrial insulation.

Steel surfaces with deteriorated paint-coatings will most likely reveal a prior anchor profile procedure (wet-dry abrasive blasting). On raw steel, high-pressure water can not alone provide a satisfactory anchor profile. Depending on a coating specification, a correct garnet (abrasive) must be metered to the high-pressure water injector (Fig. 1.72) producing this all-important anchor profile, facilitating the desired coating adherence.

Concrete surfaces, new or deteriorated, may be pressure washed, hydro-blasted (Fig. 1.73) or prepared with the UHP method, to eliminate the use of abrasive materials and achieve a variety of desired anchor profiles (surface roughness). Inspectors verifying a correct anchor profile or surface roughness (Fig. 1.74) will verify coating manufacturers recommended guidelines requiring the correct operation of surface gauging equipment.

Fig. 1.73 Defective coating

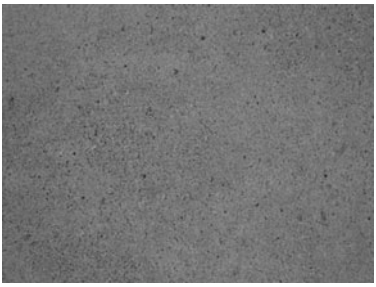


Fig. 1.74 Defective coating removed

Before commencing with high temperature surface preparations, inspectors must test the structural integrity of the hardware in question. Where insulation systems are present, inspectors will survey the hardware after the removal of possible asbestos laden insulation. Where metal wall thicknesses are insufficient, resulting either from external pitted corrosion or internal wear typically found on elbows or the lowest point of an inlet pipe component, a replacement or metal patching procedure must first be considered.

In any event, the service provider and UHP tool operator must be the final inspectorial link, especially when blasting commences while plant or hardware is in operation. Controlling the possible heat-exhaustion of the labor force involved is best overcome with a rotation procedure of the workforce (in–out), providing adequate breathing gear and work area environment (area air-conditioning, negative air space, etc.). When working in confined spaces such as in the interior of tanks, etc., the ambient temperature must be controlled to minimize flash rusting (exhaust fans, dehumidification equipment, etc.).

Federal, state and customer awareness in striving to perform a correct and safe environmentally sound maintenance procedure accelerated the development of equipment and the marketability of the coating or corrosion removal method by high-pressure water. Further, the arising environmental obligations to the contractor are more manageable in water recycling, filtration, debris separation or possible evaporation procedures, which today are recognized by structural

Fig. 1.75 Tarpaulin shrink wrap

engineers working in unison with paint and coating manufacturers, scaffolding-tarpaulin providers (Fig. 1.75), maintenance departments and contractors alike. They have begun to understand the available tool capability of high-pressure water equipment, therefore trying to accommodate service providers with technical necessities when involved in their design strategy and the endless pursuit to develop new heat resistant, elastic or hard scratch and chip proof coating systems which may require removal pressures of 20,000–55,000 psi.

To acquire bid status in refineries and chemical plants, contractors must provide adequate insurance, past and present performance standards, safety education and certification for their employees, possible and necessary equipment capabilities, prior extensive verification in similar job activities, access to qualified hydro-blasting or UHP journeyman and professional supervisors with a track record in safety, quality in scheduling, planning, job execution and in meeting their past contracting time lines. Proof of enduring relationships as contractor or subcontractor in similar plants can help greatly. Service quality, budget control and timely completion may create a preferred contractor status (Fig. 1.76).

Refineries and chemical plant maintenance departments include an array of standard must do hydro-blast applications in maintenance and plant turn-around bid procedures. By identifying plant locations, plant hardware-equipment and product manufactured in these areas, it becomes obvious that a great variety of specialized or technically refined hydro-equipment can be employed. Some of the product or by products manufactured in chemical plants and refineries are: Ammonia, sulfur, synthetic rubber, latex, base feed stock for chemical fibers, organic or inorganic fertilizers, paint base products, all varieties of fuel, coke, waxes, aromatics, graphite, lubricants-oil, asphalt-tar base stocks, pharmaceutical base stocks, etc.

APPLICATION REVIEW

Customer, Company: Web site: e-mail:		Date: Nr: Address: City: State: P.O. Box: ZIP Code:	
Purchasing	Engineering	Maintenance	Safety
Tel: e-mail: Area:	Tel: e-mail: Area:	Tel: e-mail: Area:	Tel: e-mail: Area:
Job Description:			
Job Location:	Job Site Risk Assessment:	Specify:	

Job Site Review:

Trade related publications:

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http://nassco.org

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http://www.sspc.org

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http://www.sspc.org [l6.28.407]

Safety equipment and procedures: ©

Product removal services in secondary containment areas, lube oil system cleaning, heat exchanger- boiler cleaning, sulfur condenser services.

WORKSHEET- PURCHASING - SALES

Plant-area (Fig. 1.77), hardware-equipment and general services or cleaning applications include: Hydrostatic test procedures (Fig. 1.78) which can be performed on all forms of vessels (Fig. 1.79), related production equipment and fluid transfer systems (pipelines); Cleaning new or rebuilt high velocity turbine lube oil systems (flushing), this includes debris, corrosion-rust and scale removal in

Fig. 1.76 Refinery plant

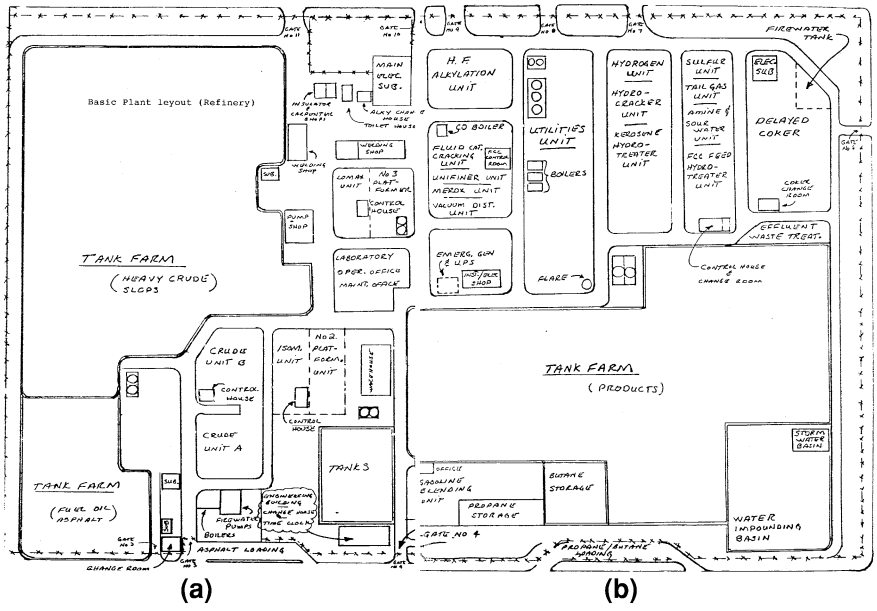


Fig. 1.77 Refinery plant area a, b

Fig. 1.78 Hydro test-block

Fig. 1.79 Hydrostatic test vessel

compressor housings, oil tanks and oil supply lines; Cleaning refinery towers' internals, fractionation trays and liquid distributors, mist eliminators, including the coke stripping on valves and related equipment or servicing atomizers, evaporators, autoclaves, reactors, and air pre-heaters, or boilers on water and fire side are standard applications and include the sulfur condenser's service (OD-ID-cleaning practice), vertical or horizontal fin fan cleaning practices (cooler-exchanger), in short, all fluid feed lines and product handling equipment can be considered subject to the hydro-blast cleaning method.

Servicing smoke stacks, cooling towers, sludge removal in settling ponds above or below water level, tank cleaning and bulk product removal services in tank farms or the correct preparation of containment areas and secondary containment facilities such as loading docks where caustic soda, hydrochloric acid, spent sulfuric acids are handled and concrete coating procedures are deemed necessary; demolition-cutting on concrete and steel structures in refineries is also considered a vital and necessary application.

Contact. Plant purchasing, engineering- maintenance and maintenance superintendents in their specific areas, general service providers such as insulation and coating companies, their inspectors for subcontracting possibilities, including specialty fabrication contractors supplying hardware and fluid transfer equipment.

Resources. http://www.goliath.ecnext.com, Petroleum refining company profiles, WJTA–SSPC, OSHA–EPA. On the Internet, "petroleum refining processes" Oil–petroleum–gas, petrochemical associations, consulting and engineering services. Mechanical contractors associations.

Safety. NPRA, national petrochemical and refiners association for safety training and requirements, http://www.npradc.org. The successful candidate will have the ability to understand and comply with regulatory requirements such as OSHA–EPA compliance of in-plant safety procedures, which includes safety training in customers' specific environment and areas. When a reactive chemical hazard possibility exists or must be eliminated, some applications demand spill prevention compliance or training and knowledge in necessary pre-job area preparation. A hit or miss strategy is under no circumstances acceptable. Clear for entry, tank degassing procedures, confined space entry permits and procedures, electrical and hardware lockout-takeout procedures, managing a gas detector program, hygienically maintaining and managing breathing apparatuses-egress systems and their use. Competent person's operating air monitoring devices, and

enforcing emergency response procedures and/or training, competent persons for scaffolding access, access equipment and tool rigging requirements are all necessary must-do basics in this application environment.

APPLICATION REVIEW

Customer, Company: Web site: e-mail:		Date: Nr: Address: City: State: P.O. Box:: ZIP Code:	
Purchasing	Engineering	Maintenance	Safety
Tel: e-mail: Area:	Tel: e-mail: Area:	Tel: e-mail: Area:	Tel: e-mail: Area:
Job Description:			
Job Location:	Job Site Risk Assessment:		Specify:
Job Site Review:			
Safety equipment and procedures: ©			
Bag house services, insulation removal, paint-coating removal, hydrostatic testing of tanks and product vessels, flu-stack services.			

WORKSHEET- PURCHASING - SALES

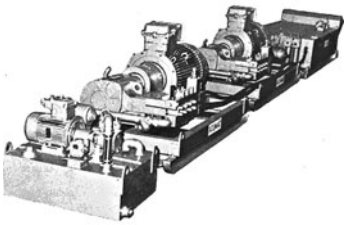


Fig. 1.80 Hydraulic-area pasting pump station

Fig. 1.81 Open pit coal mining

1.11 Coal Mines, Coal Gasification Plants, Mineral Extraction, General Mining

Light-weight, compact reciprocating pumps developed in the mid to late 1950s, ranging between 45 and 150 hp, benefited the coal mining industry immediately and resulted in the delivery of WOMAs underground hydraulic and area pasting pump stations (Fig. 1.80), operating on a 24 h, 365 day schedule. Introduced industry wide, the pump design featured a quick exchange plunger-piston configuration, accommodating water-emulsion-oil capacities required for hydraulic roof shoring gear and similar equipment. In confined spaces, gpm–psi performance criterion provided superior water-emulsion deployment when directives were given by mining and maintenance engineers for area pasting requirements (Fig. 1.81), suppressing movement of coal dust caused by underground weather (air-velocities). In sensitive areas where water accumulations must be kept to a minimum, general hardware cleaning operations where now possible due to high pressure water jetting techniques at comparatively low water volumes. It can be noted that for scientists and engineers alike, the performance capability of equipment spurred and enhanced the growing awareness of high-pressure water characteristics within coal-rock stratospheres, energizing experimental developments in coal-rock drilling (Figs. 1.82, 1.83) and general mining assist applications. Long underground distances between pump stations and confined work areas forced WOMA Corp. to immediately develop pneumatic-hydraulic pressure

Fig. 1.82 Rock-bore operation

Fig. 1.83 Rock mining operation

regulators, semi and automatic bypass valves, high-pressure oil-emulsion accumulator systems and fluid vibration-shock absorbing hp-hose fixtures to prevent wall breakouts. The correct application and installation of fluid pulsation dampeners was necessary due to the forever extending hp-hose and hydraulic line runs. In this confined but vast environment, with widespread distances between confined spaces in need of service, it became clear that the existing spring loaded hp-gun designs were inadequate due to psi range and fluid velocity–volumes–mass.

The dump gun valve and its operational requirements were impractical because of subsequent product loss or unnecessary water accumulation in the work area. This prompted the design of an hp–gun incorporating a labyrinth valve configuration (Fig. 1.84), which in operation decreases the fluid-volume's energy shock and/or loading, controlling the valves impact to its sealing surface and sealing components.

WOMAs unique invention minimized component fatigue and facilitate a safe continuous manual gun operation.

When actuating the trigger gun, pressure drops reducing hydraulic forces upon the top labyrinth valve body (Fig. 1.84), forcing an open gun position. When releasing the gun trigger into off position, the necessary hydraulic forces are reestablished, moving the valve body into a closed position (Fig. 1.85).

APPLICATION REVIEW

Customer, Company: Web site: e-mail:		Date: Nr: Address: City: State: P.O. Box: ZIP Code:	
Purchasing	Engineering	Maintenance	Safety
Tel: e-mail: Area:	Tel: e-mail: Area:	Tel: e-mail: Area:	Tel: e-mail: Area:
Job Description:			
Job Location:	Job Site Risk Assessment:		Specify:
Job Site Review:			
Safety equipment and procedures:			
Surface cleaning, tank cleaning, sewer cleaning, concrete cutting, pasting procedures.			

WORKSHEET- PURCHASING - SALES

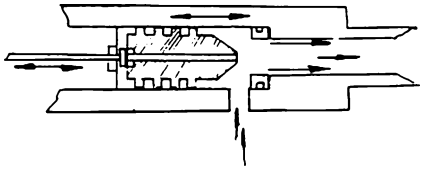


Fig. 1.84 Valve in open position

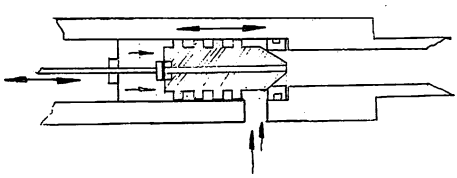


Fig. 1.85 Valve in closed position

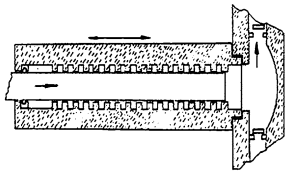


Fig. 1.86 Piston pressure stroke

The labyrinth technique was developed in this era (1967-WOMA). WOMA engineers and application technicians, managing high velocity water within a given tight gap (labyrinth valve), was transferred to a plunger–piston design. Today this technology is successfully utilized in equipment featuring packing-less plunger–piston configurations. In simple terms, the plungers reciprocating action (Fig. 1.86) produces an alternating fluid drag force (glide surfaces), utilizing in delay time the low velocity labyrinth cavities (turbulent) thus slowing the water's velocity and therefore pressure to a near zero level within the suction or pressure stroke of a plunger. Water emission is reduced to a minimum, providing adequate lubrication and cooling for plunger operations (Fig. 1.87).

Competing service providers and their crews must understand or be familiar with modern technical basics of industrial mineral extraction and process methods. Companies differentiate in how they apply separation chemistry or electrical (cathode–anode) and mechanical extraction from random rock (Fig. 1.88), coal, earth, and a variety of organic matter by crushing, grinding, smelting or liquid to liquid extraction. The latter can be a mass transfer operation, in a liquid solution (feed) and is contacted with an immiscible or nearly immiscible liquid (solvent) that exhibits preferential affinity or selectivity towards one or more of the

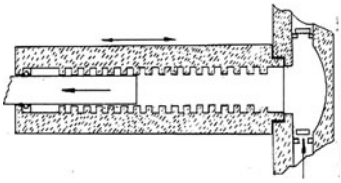


Fig. 1.87 Piston suction stroke

Fig. 1.88 Rock mining operation

Fig. 1.89 Gold extraction unit

components in the feed. Two streams result from this contact, the extract, a solvent rich solution containing the desired extracted minerals (Fig. 1.89) and the residual feed solution containing the leached waste. Regardless of which extraction method employed, the pressure washing and hydro-blasting industry will find an endless supply of applications in production cycles maintaining and cleaning equipment, plant hardware or production areas (Fig. 1.90). Within this environment, qualified service providers may be called upon to prevent catastrophic equipment failure.

Fig. 1.90 Copper smelter

Fig. 1.91 Truck services and wastewater treatment

The equipment encountered in typical mineral extraction processes include mixers, settlers, static, agitation and packed columns with random liquid distribution structures, centrifugal devices such as high-speed multistage rotary machines, product crushers, grinders and water treatment facilities. Static extraction may be performed in settling tanks (combined with axial mixing autoclaves) or cement, asphalt and plastic lined settling ponds, high heat evaporation systems or chemical processing facilities providing solvent extraction. Extraction processes substantially differ, as does the equipment in need of service. Companies may utilize boilers, heat exchangers, solvent extraction tanks, lime silos, acid wash vessels, carbon conditioning tanks, drying ovens and general feed processing hardware. Others may require sewer-pipe cleaning applications for water supply and discharge lines, including servicing waste water treatment centers and their storage tanks or evaporation facilities (Fig. 1.91). Another facet could include servicing mineral transport equipment such as trucks, railcars, conveyor equipment, transport cages, maintenance shop facilities or process machinery, including rotary disk and drum filters, trolleys, grinders, blowers, etc. Coal washing facilities require cleanup of coal dust in confined or open spaces. Utilizing the hydro-vacuum system eliminates costly air filtration methods. This includes sludge or slurry pumping from tanks and settling ponds (tailings-lime-etc.) below or above effluent-water levels, protecting sensitive pond liners in the process. This industry utilizes point source dust collection equipment incorporating fume scrubbers, air ducts and bag house systems, all in need of periodic cleaning.

APPLICATION REVIEW

Customer, Company: Web site: e-mail:		Date: Nr: Address: City: State: P.O. Box: ZIP Code:	
Purchasing	Engineering	Maintenance	Safety
Tel: e-mail: Area:	Tel: e-mail: Area:	Tel: e-mail: Area:	Tel: e-mail: Area:
Job Description:			
Job Location:	Job Site Risk Assessment:		Specify:
Job Site Review:			
Safety equipment and procedures:			
Coal washing facilities, evaporation facilities, bag house systems, maintenance shops.			

WORKSHEET- PURCHASING - SALES

Fig. 1.92 Coal gasification plant

Coal gasification plants require services on all major plant hardware components during the shutdown-turnaround procedure (Fig. 1.92). Water chillers, wash towers, vaporizers, steam drums, coolers and sour water-condensers, heat exchanger deck hardware for low temperature heat recovery, sulfur condenser, reactor equipment, quench and condensate degassing columns, scrubbers, stacks, all up and downstream equipment pipelines which includes turbine oil delivery systems and compressor gear-end or their oil tanks (when catastrophic failure has occurred), water cooling tower and water treatment facilities are some of the equipment service providers consider in a job procurement.

Applications such as cutting tank-pipe steel plate or support structures (steel, concrete, wood) in volatile environments are further possibilities. Also, one should consider water abrasive lasting or UHP services (without abrasives) as specified by maintenance departments, providing rust, paint coating or insulation removal applications. Adding the potential of delivering a necessary anchor profile or concrete roughness enhances job variety when surveying applications in the mineral mining and extraction industry. Maintenance needs and turnaround schedules are specified by purchasing and maintenance superintendents.

A pressure washing contractor wanting to break into this industry should concentrate marketing activities on the housekeeping departments of administrative buildings, their change-washrooms and building hygiene needs, cleaning exterior and interior surfaces, fleet washing, or cleaning parking garages.

Maintenance shops may also provide specific applications for in-house vacuum assist surface cleaning, or the hydrostatic test method of vessels and pipe systems (Fig. 1.93). These can be offered with equipment ranging between 1,500 and 5,000 psi (pressure washer), supplying a simple water charge pump, certified pressure relief valves for pressure washer and equipment being tested providing a mechanical or electronic certified chart recorder to establish important vessel–pipe test record by utilizing a converted dumb gun as the manual control charge valve. These types of activities may open the door for a smaller service company to gain bid status for tank cleaning applications, as well as drain, pipe and sewer cleaning jobs. There are absolutely no limitations to your marketing efforts.

Fig. 1.93 Hydrostatic test block

Contacts. Geological or mining engineers supervising construction, processing or plant operations of open pit, quarry, underground mining environments or engineers that are involved in the direct mineral processing operation of separating minerals from dirt, rock or other materials. Plant-purchasing or maintenance engineering departments for solvent extraction and leach plant processes, waste water treatment management and facilities, storage, packing, trucking and rail identities. Contact coal gasification plants; purchasing, engineering, maintenance departments and plant hardware manufacturers, or industrial coating companies for subcontractor status.

Resources. National Mining Association http://www.nma.org, Mining and mineral associations, http://www.onemine.org, WJTA–SSPC, industrial and commercial mining consultants, mechanical engineering and manufacturing facilities for upgrades and hardware design, metallurgical engineering services and their process engineering departments associated with gold, copper, zinc, uranium, tungsten, nickel, tin, etc.

Safety. A multitude of safety procedures will be encountered in this industrial environment and requires an in-plant safety training obligation for the contractor's crew and can include a "Hazard-Awareness Assessment Program" for surface and alternative mines. A mining safety engineer will always be present or involved in one form or the other. They are responsible for labor safety, monitoring-verifying mining environment, operational-performance in safety and equipment-hardware compliance. Oxygen deficiency, explosive atmosphere and exposure to toxic gases and vapors are possible. All federal-state and in-plant safety requirements are enforced (OSHA–EPA). Frequently applications require a combination of controls.

APPLICATION REVIEW

Customer, Company: Web site: e-mail:		Date: Nr: Address: City: State: P.O. Box: ZIP Code:	
Purchasing	Engineering	Maintenance	Safety
Tel: e-mail: Area:	Tel: e-mail: Area:	Tel: e-mail: Area:	Tel: e-mail: Area:
Job Description:			
Job Location:	Job Site Risk Assessment:		Specify:
Job Site Review:			
Safety equipment and procedures:			©
Servicing Pelletizing plant, water treatment facilities, rail and field services.			

WORKSHEET- PURCHASING - SALES

Fig. 1.94 Coffee roasting unit

1.12 Coffee, Tea, Cocoa Seeds, Leaves, Herbs Extraction-Processing

In 1954, the founder of WOMA Corp., selling chemicals, disinfectants and pump equipment to dairies, concentrated and/or granulated milk producers,realized the opportunity to develop and manufacture mobile and stationary plant equipment. Heating hardware and related plant equipment (boilers, condensers, evaporators, cyclones, tanks, etc.) developed excessive hard, stubborn or bulk contaminants in milk concentration, powder operations and pasteurization processes. By applying high-pressure water as a tool he realized the great reduction in cost compared to manual and chemical cleaning methods then standard within this industry. Municipal sewer and pipe cleaning methods, also in their infancy, applying the high-pressure water hose propulsion technique (water jetting equipment), combined with the emerging oil-hydraulic high-pressure oil transfer hose technology (external steel wire reinforced), enabled him to adapt these technical developments for the cleaning method with high-pressure water, and in doing so, delivering application techniques as the pressure washing and hydro-blast industry identifies these today. For contractors already involved in the food or beverage industry it is a natural to consider the specialization of their service capability for manufacturing plants of heat sensitive and aroma based consumer products. The extraction, centrifugal separation, concentration, filtration, aroma preservation, drying, spray drying, agglomeration-granulation and powder handling procedures (Fig. 1.94) and their subsequent process hardware are all individual identities in need of pressure washing or hydro-blasting services. Extraction methods found in these environments may differ with seeds, leaves or plant identity, which may include the extraction and isolation of major food additives, pharmaceutical or industrial base byproducts.

The coffee, tea and cacao bean extraction process and their evolving byproducts may show some similarities in manufacturing hardware being serviced (heat exchangers, filters, evaporators, tanks, process pipes, etc.).

Fig. 1.95 Process container-tank

Decaffeination of coffee-tea or the spice and herbs extraction process (pulping) can also be achieved through a water extraction method, in which, for instance coffee beans are soaked, steamed and rinsed allowing the caffeine to defuse from the beans into the water using no artificial chemicals.

Application variety and tooling will change in the direct solvent extraction method. The decaffeination is accomplished by direct application off ethylene chloride, ethyl acetate or carbon dioxide to the coffee beans. The beans are then steamed to remove the residual solvents, dried and roasted. Plant hardware differs from the water extraction method.

Cocoa derived from the cocoa plant (cocoa-beans), and utilized for cocoa milk, chocolate, confections, but also for the extraction of Theo-bromine, a light central nervous system stimulant as well as Theo-phylene, a mild stimulant derived from the tea leave and applied in pharmaceutical products, will differ only slightly in tooling and gpm–psi requirements. Considering only a few extraction processes it is obvious that there are vast application varieties and service possibilities available to the high and low-end service provider.

Health, sport or boutique oriented products requiring plant extraction processes belong within this category and must be considered by the low-end service provider in smaller commercial business identities (Fig. 1.95). The growing specialty product market, such as the development of the micro brewery industry, opened the door for the low-end contractor (3-5,000 psi), especially when acquiring knowledge in industry safety standards, hygiene and technical expertise.

APPLICATION REVIEW

Customer, Company: Web site: e-mail:		Date: Nr: Address: City: State: P.O. Box: ZIP Code:	
Purchasing	Engineering	Maintenance	Safety
Tel: e-mail: Area:	Tel: e-mail: Area:	Tel: e-mail: Area:	Tel: e-mail: Area:
Job Description:			
Job Location:	Job Site Risk Assessment:	Specify:	
Job Site Review:			
Safety equipment and procedures: ©			
Evaporation facilities, bag house systems, maintenance shops, boilers			

WORKSHEET- PURCHASING - SALES

As in the food and beverage category, coffee, tea, cocoa and herb extraction methods vary and offer a wide variety of process machinery (Fig. 1.96): Boilers, heaters, heat exchangers, evaporators, mixers, box driers, cyclones or centrifugal separators, vacuum drying equipment such as distillation equipment, air–gas–liquid filtration systems of all types, freeze driers, roasters, grinders,–refrigeration

Fig. 1.96 Pasteurizing equipment

and cooling environments, bag house units, smoke stacks, wet and dry storage tanks and so forth.

The low-end contractor concentrates his service capability on in-plant cleaning schedules, specializing in machine shop cleanups, cleaning of transportation equipment such as delivery and product supply trucks, manufacturing equipment, product storage facilities, silos, tanks, conveyor belt systems etc., or sterilizing and possibly chemically treating production floors and production equipment, which may include the hygiene areas for the plant labor forces, servicing exterior administrative offices, parking facilities, truck loading docks and so on. Researching the extraction plants technical environment is of vital importance for future service possibilities.

Contracting opportunities may be seasonal. The high-end service provider will find most industrial application identities within this field. Acidic-corrosive environments can be encountered and require metal preservation procedures within boiler, condenser and tank cleaning operations. Food grade paint-coating removal and installment applications in secondary containment areas and production floor environments are also not unusual. Servicing water treatment facilities, their storage tanks and filtration units is a reoccurring application criterion.

It is an advantage to understand the multiphase operating systems encountered, which may incorporate natural raw material extraction and separation technology, atmospheric process systems, reflux or heat elevated pressure processes.

Contacts. Manufacturer's engineering, purchasing, maintenance superintendents for contracting status and possibilities. Process engineers specialized in food drying–freezing and hardware such as air suspension drying equipment, atomizing, fluidized bed drying facilities, flash drying and rotary or spray drying procedures. Consulting services for roasting companies involved in business start-up and expansion. Manufacturers producing artificial sugars, herbal oils and ointments

APPLICATION REVIEW

Customer, Company: Web site: e-mail:		Date: Nr: Address: City: State: P.O. Box: ZIP Code:	
Purchasing	Engineering	Maintenance	Safety
Tel: e-mail: Area:	Tel: e-mail: Area:	Tel: e-mail: Area:	Tel: e-mail: Area:
Job Description:			
Job Location:	Job Site Risk Assessment:		Specify:
Job Site Review:			
Safety equipment and procedures: ©			
Condenser, box driers, tanks, centrifugal separators, stacks.			

WORKSHEET- PURCHASING - SALES

utilizing supercritical fluid extraction and pharmaceutical-bio chemical extraction processes, the beverage industry producing organic teas, coffees and juices, etc.

Resources. On the Internet, "Coffee extracts, decaffeination process", much of today's manufacturing and product extraction specifics can be researched and

studied, plant hardware manufacturers, plant engineering departments, Specialty Roasters Guild of America, the directory for coffee marketing database (Associations), the National Food Processors Association, for contractor's equipment, WJTA, PNA, CETA, SSPC.

Safety. In addition to understanding and enforcing state and plant food safety-hygiene regulations (FDA compliance), a multitude or combination of controls may be necessary, including confined space entry permits, lockout-takeout procedures, hazardous material handling capability and so forth. Permitted in food for human consumption (bulk chemicals) are food additives, microorganisms, chemicals and polymer substances which are present in specific containers and/or fouled manufacturing equipment identities and may pose a threat to the labor force in a condensed, liquid or gaseous state. Code of federal regulations: 21 CFR173 secondary direct food additives http://www.foodsafety.org.

1.13 Cement, Lime Manufacturing, Ready-Mix Concrete Industries, Prefabricated Building Assembly, Pipe, Brick and Block Manufacturing

The Portland cement and lime manufacturing environment, a relatively small industrial identity in the late 1950s, was a significant contributor, not only for service opportunities in a wide variety of power washing and hydro applications but also in its support of practical how-to demonstrations within specific experimental tool development stages. In this environment, working with water seemed ludicrous. Introducing high-pressure water jets to dolomite lime (hydration) or cement dust encrusted equipment, including layered deposits on roof structures, plant structural framing, and hardware was not yet heard of. This created a far-reaching skepticism with maintenance superintendents. Sentiments have changed within the last 40 years. Understanding the environmental pressures, air emission standards, control practices-equipment and hydro tool developments, the safety oriented service provider, knowledgeable in plant operations, familiar with wet or dry production processes and aware of the possibility of high or low reactivity of cement or lime dust to moisture, has changed this sometimes adverse opinion. The successful manipulation of large (dry-wet) product volumes or product-scale behavior, adherence parameters, tensile strength and product solubility when introduced to high-pressure water are today well documented fact.

Traditionally, to maintain a kiln in operation, the clinker ring buildup fragmentation in problem areas was performed via an externally mounted Remington cannon or other mechanical means. The hydro-method is based on thermal shock fragmentation, applying high pressure, low-volume bursts directly to the clinker buildup (Fig. 1.97) within a 75–100 feet distance from the inspection apertures while the kiln rotates in a semi-full production cycle, thus maintaining necessary

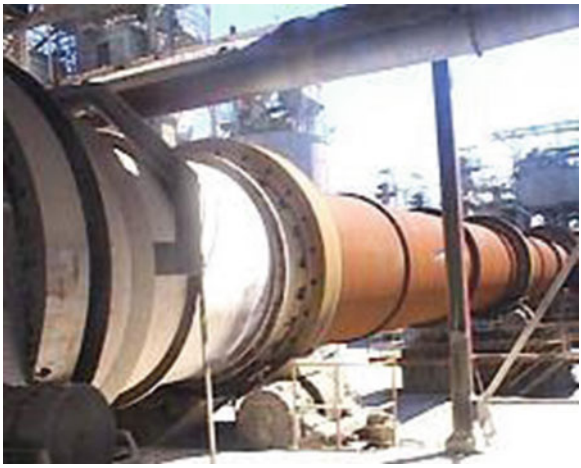


Fig. 1.97 Cement–lime kiln

internal kiln temperatures. While in rotation, correct nozzle-lance configuration (angulations) prohibit structural and fire brick damage (refractory). Comparatively minute or necessary water volumes will keep developing gases within operating guidelines while effectively cooling the hp-lance and nozzle assembly. Initially, the fracturing process with high-pressure water was developed by utilizing technical experience gained in clinker removal services performed by contractors in fossil fueled (coal) steam boilers during the early 1960s with WOMA Corp. equipment. The sheer length of modern cement–lime kilns (60–980 feet) and today's operational efficiency may render this clinker removal method inadequate, except in areas where hydro lance access to clinker build-up can be provided (control-inspection aperture). There are approximately 250 cement–lime manufacturing operations within the continental USA to be pursued by contractors. Lime manufacturing facilities are not necessarily part of a cement plant. Lime production or lime reclamation can also be found in the pulp-paper industry, sugar refineries and so forth. They burn calcium and or magnesium carbonate, calcareous materials as coral, chalk and shells or a mixture of liberating carbon dioxide to obtain the derived oxide. The calcium oxide product from the kiln is generally crushed, milled or screened and stored in silos. From storage, the burned lime is delivered to the end-user in the form of quick lime or transferred to a hydrating plant where it is reacted with water to produce slacked lime. A contractor's technical and sales force must study the integrate pollution prevention and control mechanisms and their necessary plant equipment identities. Fugitive dust emissions and debris buildup are comparable to cement kiln operations and therefore abatement and hydro-blast cleaning procedures are similar. Job set-ups differ between kiln type and size, wet or dry process, plants' product volume manufactured and vertical shaft kilns found in antiquated or smaller companies producing specialty products. Depending on the job description it may also be

Fig. 1.98 Kiln bag house and air filtration

important to be familiar with the energy type utilized within the clinker burning process.

The hydro-blasting service provider will navigate his potential to air filtration systems to clean bag house units (Fig. 1.98), stacks, flues, electrostatic precipitators-scrubbers (wet or dry scrubbers), closed-loop water treatment facilities, removal of sludge-lime-dust deposits in settling ponds, gravel bed filters, cooling towers, silos, tanks and agitators. The hydro vacuum unit either directly employed or fitted with a mobile product recovery box of 20–40–60–80 yard capacity, will always be of advantage within these types of applications. Especially where increased water usage must be kept to a minimum within the destruction of semi solid concrete waste, or where lime-cement dust and silica buildup, filter cake sedimentation must be dredged below or above water, liquefied, pumped, moved or loaded.

Removal applications of tough scale or sedimentation found on internal in-plant hardware, produced by the closed loop plant water which is laden with calcium carbonate, chloride, magnesium, iron, silica traces and enriched with sulfuric acid to balance water (ph-seven) are of a general nature. This includes hydrostatic test procedures with turbine oil or de-mineralized water on pressurized plant equipment, tanks or cleaning plant's oil lube systems, oil-compressors, fuel storage and transfer equipment, etc.

High or low temperature paint and coating removal applications may be required when a premature brick failure (refractory) occurs on a pre-heater kiln, main kiln, clinker cooler, or refractory lined vessels, resulting in a localized shell deformity, forcing a unit shutdown. During the 16–20 h cool down period, plant masons and maintenance superintendents will coordinate refractory or partial refractory repair strategies. Hydro-blasting or UHP jetting procedures, removing brick's adhesion material from the interior shell reduces not only the overall replacement cost but is environmentally friendly. Replaced steel can quickly be water-sandblasted on site, creating the crucial anchor profile. Not all kiln plant environments employ their own bricking masons or equipment (bricking robot

Fig. 1.99 Blending equipment

Fig. 1.100 Ready mix plant

equipment). It is advisable to locate kiln, maintenance identities involved in this work for business opportunities.

The power washing contractor (3–5,000 psi.) should consider servicing equipment in maintenance yards (over 8000 quarry operations exist), their equipment and shop facilities, conveyor systems, crushing, grinding, milling, proportioning, blending equipment or areas (Fig. 1.99) and loading ramps, load towers, product packaging equipment labor hygiene areas, etc. Power-washing companies do best when including water pick-up, filtration and recycling equipment capabilities in their general services. Following the cement–lime product trail into ready mix plants (Fig. 1.100) paving plants, concrete reclaim facilities and portable mobile batch plants will greatly enhance marketing perspectives.

Fig. 1.101 Concrete batch equipment

Fig. 1.102 Concrete precast yard

The ready-mix concrete industry exploded in the last few years to over 5,000 plus batch plants (mobile-stationary) throughout the continental USA offering power-washing, hydro-blasting and UHP contractors a wide variety of opportunities. Concrete batch equipment (Fig. 1.101), identified as low profile-central, transit mix plants and paving plants, must be serviced before, during and after job completion. Tilt mixers, hoppers, tanks, cement silos, conveyor equipment, cement and concrete mixer trucks are the service targets. Primarily their function consists of mixing water, cement, sand, gravel or crushed stone and delivering it into a customer's construction site in an unhardened state. Today's entrepreneur specializing in this field will justify the necessary equipment investment by providing application flexibility, versatility with his hydro tooling and support equipment, demanding a wider customer base within a construction cycle or throughout the general construction and maintenance environment, including offering services to heavy equipment rental yards and used construction equipment suppliers.

Stationary pre-cast companies and their batch plants (Fig. 1.102) which manufacture pipe, brick, block, architectural components and hollow core concrete extrusion products such as building panels (Fig. 1.103), bridge girders, underground tanks etc., also belong to the customer base of a quality contractor servicing the cement, lime, and concrete industry. Their tooling requirements also permit offering services to pottery, ceramics and plumbing fixture manufacturers engaged in shaping, molding, glazing and firing ceramics. This also includes the glass product, glass fiber manufacturing industries, where again, a high temperature conversion of various raw materials (milled quarry products, recycled glass),

Fig. 1.103 Building panels

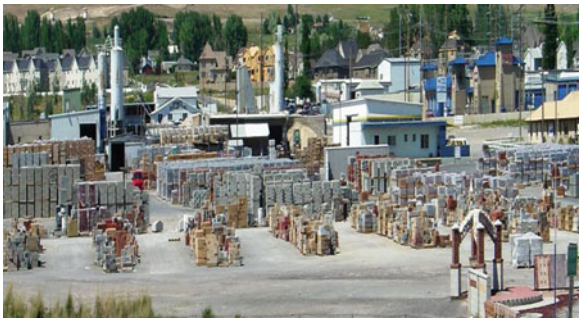


Fig. 1.104 Brick-block and building composite's yard

predominantly borosilicate, is the prime process requiring services, such as cleaning refining equipment, heat exchangers, boilers, condensers, flues, tanks, water, air filtration equipment and last but not least, their specialty equipment producing the end product.

Contacts. Quarry supervisor, engineer maintenance personnel, yard foreman (Fig. 1.104). Cement process consultants, Cement–lime plant purchasing, maintenance and waste management personnel. Concrete batch plant operator, maintenance supervisor and concrete transportation identities. Pre-cast companies, plant purchasing, maintenance superintendents, construction planning, construction site's project engineer, project specifying personnel, architects, field engineers, field superintendents, etc.

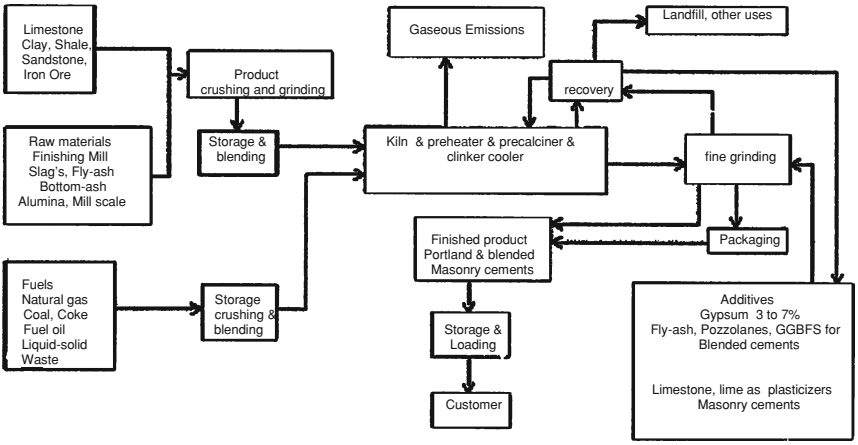
Resources. Cement and Concrete basics (http://www.cement.org). Equipment, WJTA–SSPC–CETA–PWNA. Manufacturing locations, quarry-cement–lime manufacturing associations, the area chamber of commerce, all other identities applying high heat processes to quarry and industrial byproducts, PCA—Portland Cement Association, NPCA—National Precast Concrete Manufacturers Association, http://www.precast.org.

Safety. Guard against eye, skin and respiratory tract irritation from exposure to cement dust, heat exertion, awkward work posture, chemical burns, incorporate safety gear for caustic-gaseous environments, possible oxygen deprivation and provide slip-trip-fall protection. Oversee safety meetings before job commencement and tailgate meeting with the labor force. Study safe practices in cement and

lime plants (Internet). Request details from specific trade associations. In general consider all industrial, OSHA and in-plant must-do safety regulations. Most environments and applications require a combination of safe practices, safety gear and safety training and may differ between job assignments.

APPLICATION REVIEW

Customer, Company: Web site: e-mail:		Date: Nr: Address: City: State: P.O. Box: ZIP Code:	
Purchasing	Engineering	Maintenance	Safety
Tel: e-mail: Area:	Tel: e-mail: Area:	Tel: e-mail: Area:	Tel: e-mail: Area:
Job description:			
Job location:			
Jobsite Review:			



Safety equipment and procedures: ©
Product manufacturing equipment, flues, precipitators, stacks, conveyor belts, trucks, heat exchangers, cooling towers, kilns, water treatment facility.

WORKSHEET- PURCHASING - SALES

1.14 Dairy Foods, Byproducts and Derivatives, Milk Processing, Concentrates, Powders, Refrigerated-Frozen Dairy Products

In the early 1950s compact reciprocating pumps featuring low water volume at comparatively high pressure configurations (1,200 psi) were introduced by FMC Myers Corp., USA. The commercial and industrial versatility of this equipment proved valuable to Mr. Wolfgang Maasberg Sr. the founder of WOMA Corp. Subsequently, surprising Myers Corp. by his modifications and add-ons, transforming their equipment to then unknown commercial-industrial identity introduced to the USA as Hydro Blast Equipment, or today referred to as Water Blasting Equipment, in Europe-England (WOMA-England) as Water Jetting Equipment and in Germany as Hochdruck-Wasserstrahl-Gerate, later registered as ATÜMAT (High Pressure Water Jet Equipment). In 1954 Wolfgang Maasberg's company, in its infancy, was selling industrial pumps, chemicals and chemical cleaning solutions to the dairy and general food industry. It became apparent that after a dairy's high heat processing cycles, most hardened product residue and bulk material adhering to the disassembled manufacturing hardware could be removed with available water pressures, manually administered with a rudimentary spring controlled valve assembly, similar in appearance to that of a pistol, hence in German "hochdruck wasser strahl pistole" (high pressure water jet gun). In avoiding equipment disassembly or reducing obvious chemical, time and labor costs to the customer, the need to provide specialty tooling designed to manipulate water jets in hard to reach or distant internal equipment areas spawned WOMAs future. This prompted aggressive business and engineering commitments by persistently developing new tool capabilities for application procedures not yet available to the general industry.

The pressure washing contractor, cleaning and sanitizing the dairies free or tie stall barns (Fig. 1.105), tunnel ventilation systems, automated and gravity flow manure gutters, feed storage silos, tractors-animal trailers and farm equipment, etc. or making use of his pressure washing equipment's hydro-vacuum system in servicing settling ponds or underground tanks (sludge-sedimentation removal practices, etc.) which includes cleaning water treatment facilities and regenerating water wells, could consider expansion of his service capabilities to the milk parlor environment.

In researching this possibility he will realize quickly that hygienic work habits, sanitation, hygienic support equipment, hydro tool design and the use of chemical applications differ greatly when compared to livestock areas and equipment cleaning operations.

Regardless of the contractor's prior quality in labor hygiene practices and general sanitation programs, when in job solicitation or cleaning operation, he must incorporate and perform a series of protocols and personal equipment cleaning procedures, aimed to eliminate possible prior exposure possibilities (feed

Fig. 1.105 Dairy feed stall

Fig. 1.106 Dairy milk parlor and equipment

and livestock area) to avoid a cross contamination into the milk parlor or dairies product manufacturing environment (Fig. 1.106). The possibility of spreading foreign organisms and bacteria, including unidentified soil and microbial product residue from prior jobs. or human viral influences cannot be permitted.

When involved with dairy purchasing and maintenance departments, it is especially important that one adheres strictly to the established controls that prevent, reduce or eliminate problems from occurring. Contractors are under intense scrutiny to avoid any possible introduction of foreign micro-organisms such as bacteria, mold or yeast to the milk processing environment which also results in poorer product quality and shelf life.

APPLICATION REVIEW

Customer, Company: Web site: e-mail:		Date: Nr: Address: City: State: P.O. Box: ZIP Code:	
Purchasing	Engineering	Maintenance	Safety
Tel: e-mail: Area:	Tel: e-mail: Area:	Tel: e-mail: Area:	Tel: e-mail: Area:
Job Description:			
Job Location:			
Jobsite Review:			
Safety equipment and procedures: ©			
Tanks, tanker trucks, loading docks, cooling towers, water treatment facilities.			

WORKSHEET- PURCHASING - SALES

Fig. 1.107 Dairying plant

When establishing a sanitation program, the plant's (Fig. 1.107) maintenance-process engineer and laboratory personnel must be involved to identify and prioritize remedies against the possible introduction of harmful organisms. The contractor should advise or design with the customer the necessary chemical resources, composition and ratios to be applied with high-pressure water before, during and after cleaning requirements. This includes identifying adequate blast water for areas or equipment in question, equipment changeover to various plant locations, equipment breakdown, sanitation and correctly discarding job essentials such as gloves, coveralls, tarpaulin, earplugs, spent eye wear, empty containers, etc. after a job completion. To be effective, every service provider's employee must know that it is part of his or her job description to eliminate the risk of contamination possibilities to the area, equipment and product by effectively implementing established sanitation guidelines. All written procedures and statements must be signed by maintenance-laboratory personnel, providing the job history. The validated program is added to the bid paperwork, gear-equipment-job report folder and must be saved for possible inspections or verifications.

It is of an advantage to be knowledgeable of the plants hazardous analysis, critical control point system (HACCP) and guidelines, providing the operational quality assurance within specific production-equipment-hardware (Fig. 1.108) or plant areas to by serviced.

This does not necessarily rely on testing the final product manufactured but concentrates more specifically on internal hygiene, laboratory tests of all milk products and their contact surfaces, plant operating temperatures and equipment operating parameters throughout all storage—sterilization–pasteurization—manufacturing cycles and plant maintenance processes.

Today's milk processing environment and product cycle is highly automated and features a clean-in-place system (CIP) and procedure, accommodating the industry's necessary cleaning ordinances or better cleaning intervals for raw or heat treated milk storage facilities, including all inline milk contact surfaces (Fig. 1.109) of plant processing equipment.

Fig. 1.108 Dairy product vessels

Fig. 1.109 Cream pasteurization equipment

Milk contact surfaces may feature a variety of scales (milk stone, powders, fats, etc.) and differ not only by product being manufactured and transferred, but also vary do to CIP flushing or cycling of specific dairy detergent-wash solutions. These may be chlorinated alkaline or hot-acid-caustics, low or high temperature fluids and are designed for plants specific process and hardware requirements. The solution is circulated throughout the system with a relatively high fluid velocity and then returned to the holding reservoir.

APPLICATION REVIEW

Customer, Company: Web site: e-mail:		Date: Nr: Address: City: State: P.O. Box: ZIP Code:	
Purchasing	Engineering	Maintenance	Safety
Tel: e-mail: Area:	Tel: e-mail: Area:	Tel: e-mail: Area:	Tel: e-mail: Area:
Job Description:			
Job Location:			
Jobsite Review:			
Safety equipment and procedures: ©			
Water pretreatment plant, boilers, condensers, evaporators, filtration systems.			

WORKSHEET- PURCHASING - SALES

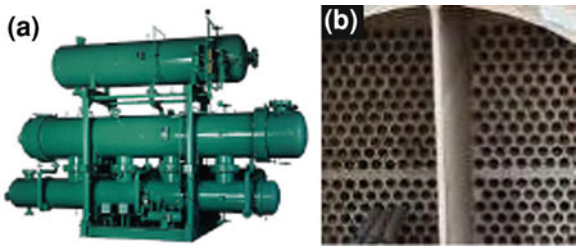


Fig. 1.110 **a** Chiller-condenser, **b** condenser tubes

Offering cleaning procedures and application technologies with limited or non misting side effects (overspray), utilizing available hydro vacuum systems-equipment and recycling the necessary blast water within the dairy environment will find a positive response from maintenance superintendents, laboratory personnel and purchasing-management alike.

Elevated water pressures are mainly necessary in the high heat producing part of the plant. Cleaning milk powder equipment, their product lines, conveyors, boilers, heat exchangers (Fig. 1.110a, b) water and milk evaporators, cooling towers, filter housings and waste water treatment centers, sewers and drainage pipes are some more of the general hydro-cleaning varieties encountered.

Typically, a service provider will gain access to the milk reception, processing, product manufacturing and storage-distribution areas only when a facility malfunctions or a routine plant shutdown is imminent. Modern dairies feature an abundance of welded and continuous product transfer pipes (Fig. 14.7), tanks and silos, hopefully with strategic access ports, permitting the application of flex lance technology and equipment. To achieve high velocity water access to all hidden or cumbersome internal areas, gasket, flange and possibly inaccessible pipe surfaces are in need of special attention when hydro-tool selections are considered. In large plants, milk tank trucks are cleaned and sanitized internally. Maintenance departments verify and tag each time the tanker is cleaned and perform a log book record for each procedure. This does not mean that external truck cleaning operations cannot be offered.

Ice cream and frozen yogurt manufacturing facilities are another opportunity for service providers. The conversion of skim milk, milk fat, milk solids, sucrose, corn syrup, emulsifiers and specialty ingredients into ice cream or yogurt by fermentation, blending, mixing, pasteurizing, homogenizing, aging, freezing, hardening, packaging, storage and distribution offers numerous application varieties. Milk, milk byproducts, fruit, chocolate and a diverse variety of ingredients added to the variety of manufactured products demand the same diligent operational integrity, applying hygiene, sanitation and biosecurity guidelines. Product transfer pipes (Fig. 1.111), silos, tanks, filtration equipment, heat exchangers, boilers, cooling towers, refrigeration-freezing equipment, waste water or water treatment centers, trucking and warehousing are all points of interest.

Contacts. Farm-Dairy-operations, unit managers, feed managers, veterinarians, feed suppliers, Artisan cheese and ice cream manufacturers, farm equipment

APPLICATION REVIEW

Customer, Company: Web site: e-mail:		Date: Nr: Address: City: State: P.O. Box: ZIP Code:	
Purchasing	Engineering	Maintenance	Safety
Tel: e-mail: Area:	Tel: e-mail: Area:	Tel: e-mail: Area:	Tel: e-mail: Area:
Job Description:			
Job Location:			
Jobsite Review:			
Safety equipment and procedures: ©			
Feed silos, silo cleaning, mist eliminators, general building sanitation.			

WORKSHEET- PURCHASING - SALES

Fig. 1.111 Dairying transfer pipes

repair-maintenance and dairy product storage (refrigeration) and transportation facilities, etc.

Resources. Equipment, WJTA, CTA, PNA, for coatings SSPC, dairy industry resources thru the Internet, dairy breed associations, local dairy associations, local, national and international dairy foods associations, states milk inspection services, etc.

Safety. Milk and dairy food safety guidelines, US-FDA, USDA, a multitude of industrial safety, sanitation, hygiene, operator training and supervision procedures are required. http://www.cfsan.fda.gov.

1.15 Fish Hatcheries, Aquatic Farm Environments, Tropical Marine Livestock Centers, Secondary Fish Processing Plants, Lake and Pond Management, Fish Processing

Marine and freshwater aquaculture can be as the growing of fish and shellfish to supplement natural supplies for recreational, tribal, commercial and scientific purposes. At this point, everyone understands that during the last 40 years oceans suffered unsustainable harvesting practices. Overall counts of many species are dangerously low and cannot be expected to maintain their existence by natural procreation alone. Global seafood consumption, national-international fishing fleet's offshore production capabilities, combined with the degradation of ocean and landlocked spawning habitats by human populations, growth-activities and subsequent ecological changes are the major forces which accelerated research, development and construction of marine-freshwater aquatic farm environments.

Fig. 1.112 Fish farm ponds

The maintaining of fish health and their procreation in large numbers in a confined space was the number one research-development question, which today results in the aquaculture product penetration to markets in the millions of tons.

Fish-farms, hatcheries–nurseries rearing (Fig. 1.112), donor, brood fish pond design-structures and commercial holding facilities differ by species (cold-cool-warm-water), as do the water recirculation-treatment facilities and their possible leach field layouts. The fish farm water source may also vary and could be ocean, lake, stream, spring, surface or deep well water. In the early 1960s, with the growing consciousness of biologists to better manage bacterial and biological controls in the fish farm-hatchery environment, maintenance personnel began utilizing a 150 hp hydro-blast unit, displacing the sewer jetting technique. This resulted in a more effective rust, algae and bacteria removal practice of offshore salt water supply and discharge lines operated by land-based marine hatcheries. Ever since, power-washing and hydro-blast applications have been administered in the aquatic farm environment.

Hot water above 190°, at 3–8,000 psi removing bulk contamination (aquatic growth, sedimentations, various scales, etc.) in its wake neutralizing harmful bacteria not only on surfaces but also in otherwise difficult to penetrate crevices, reset gasket areas, concrete fissures, etc. also results in a chemical cost reduction when final startup prep procedures of equipment and related structures are performed. Cleaning feed equipment and silos, tanks, commercial holding facilities, interior or exterior race ways (Fig. 1.113) degassing units for catfish hatcheries, packed column aerators and water treatment center equipment, including pipes, filtration equipment and chillers, are considered general pressure washing applications. Fish farm or hatchery laboratories will advise as to the correct application of disinfectants, for instance, applying a nonselective germicide (1% active iodine) as is often utilized in laboratories and veterinarian facilities. Balancing fish pond ecosystems and water quality standards are a vital management facet in farming operations. Service companies should be able to perform water chemistry analyses and interpretation to support ongoing application endeavors.

Fig. 1.113 Race way facility

Fig. 1.114 Fish pond environment

The hydro-vac dredging method can be utilized in several ways and is preferably applied as a preventive pond cleaning procedure, removing fish-waste-feed-algae controlling ammonia and nitrite levels, etc. before a fish kill occurs, or in a prime dredging operation servicing pond bottoms (Fig. 1.114). Dredging operations can be performed at or below water levels, not disturbing or damaging sensitive soil-clay-plastic pond liners. Gravel beds can be pulled, gravel cleaned and returned to pond bottom and the effluent can be pumped directly to leach fields, tanker trucks and water filtration-recycling systems. In this application the hydro-vac method is far superior, providing application versatility, tool variety and cost effectiveness in comparison to other dredging operations.

Expansion or renovation of existing hatcheries, spawning facilities, concrete raceways, etc. may call for partial-total concrete or coating removal, construction site or prep-cleanup. Serious contractors will pursue and qualify for a subcontractor status with all structural and equipment manufacturing identities involved within the aquatic farm industry. A variety of hydro blasting and pressure washing techniques found in the aquatic farm environment can also be transferred to the tropical marine rearing, holding and exhibition environment. Lake and pond

Fig. 1.115 Processing equipment

management companies also share similar job opportunities, but most likely are not driven by the high priority sanitation concerns fish farms-hatcheries-processors must consider.

Developing national and international industry trends, incorporating processing capabilities adjacent or within a fish farm environment expands the overall application variety and business opportunity into the processing (Fig. 1.115), packaging and transportation field.

On-shore seasonal or periodic manufacturing schedules, species variety and the variation in processing systems in today's conversion of raw materials for human consumption, revolves around or includes freezing, drying, smoking, spiced-marinated (pickled) products, cooking, frying-breaded, canning, vacuum packing, cold storage, etc. Most large canneries also operate a fish meal and/or fish oil production facility, applying high heat and vacuum, drying, grinding processes.

The hazardous analysis critical control point system (HACCP) and specifications varies between processors and is tailored to their specific production needs. Opportunities for pollution prevention, odor control, bacteria-decontamination procedures, cleaning process equipment, production areas and so forth between seasonal or product manufacturing cycles, differ from most at sea processor environments.

Studying spawning facilities within the food industry segment encountered will quickly enlighten a service provider of possible application opportunities. Following the in-plant water usage trail, which includes water for refrigeration systems, washing of raw materials and process equipment, conveying products from one process area to another, dissolving and extraction processes, steam generation for cooking-heating, evaporators and turbines, etc. ending with cooling towers and water treatment facilities is a clear indicator to the abundance of application possibilities Fig. 1.116.

Fig. 1.116 Spawning facilities

Soiled boilers, condensers, heat exchangers, cooling towers, refrigeration equipment, wastewater treatment facilities, manufacturing floors including receiving-distribution areas provide standard application identities to contractors.

A bacteria free environment is essential to shellfish producers. The service provider may offer scale removal-cleaning of water supply pipelines over extensive distances, under water cleaning of shellfish breeding surfaces, removing barnacles on stock pylons and separating kelp from base material-surfaces.

Within this environment 90% of applications are performed with hot or cold water between 3 and 12,000 psi. Offering an expert chemical application procedure by providing a precise chemical-water ratio metering control is also of importance to the customer.

Fresh, round or dressed, frozen fish, fillets, shellfish and crustacean products are highly susceptible to texture breakdown, decomposition, discoloration and flavor changes caused by a multitude of natural and circumstantial factors. Supervisory and maintenance personnel striving to minimize spoilage, maintaining their product integrity, desired palatability and shelf life, demand that a contractor or service provider perform his operation within all specified plant ordinances, varying by species and subsequent products manufactured. The FDA's food hygiene requirements and guidelines concerning personnel and equipment utilized by service providers are always enforced.

Contacts. State fish hatchery complexes, Fish and wildlife services (USFWS), state water conservation districts, licensed and authorized commercial and private hatcheries, consultants for design, construction of fish hatcheries, aquaculture consultants for shellfish and marine fish farming, fish feed manufacturers, the laboratories involved with fish health, environmental monitoring and technology, fisheries-fish-farm biologist and supervisor. Aquaculture water treatment facilities and reclaim systems, engineering and design-management identities. Fish stocking operations, and transportation companies, fish processor, their purchasing-maintenance departments, specialty products operations, canneries, etc.

Resource. For equipment, contractors, coatings, WJTA, PNA, CETA, SSPC, plant's HACCP system identifying FDA's critical inspection points.

Safety. FDA's and OSHA regulations are enforced, according to application encountered, many applications frequently require a combination of controls and all industrial standards can be expected.

APPLICATION REVIEW

Customer, Company: Web site: e-mail:		Date: Nr: Address: City: State: P.O. Box: ZIP Code:	
Purchasing	Engineering	Maintenance	Safety
Tel: e-mail: Area:	Tel: e-mail: Area:	Tel: e-mail: Area:	Tel: e-mail: Area:
Job Description:			
Job Location:	Job Site Risk Assessment:		Specify:
Job Site Review:			
Safety equipment and procedures: ©			
Boilers, condensers, chillers, cooling towers, production facilities.			

WORKSHEET- PURCHASING - SALES

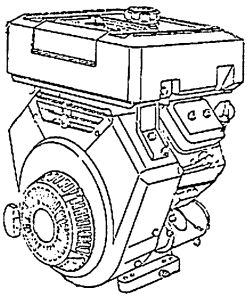


Fig. 1.117 Briggs and Stratton

1.16 Food Service Industries, Food Processing Companies, Produce Retailers, Suppliers, Trucks-Trailers-Tankers-Railcars

The question as to who was first to utilize, "high-pressure water as a tool within 1,500–3,000 psi at 5 gpm or less, is probably related more to when cost effective and reliable engines were available to withstand the demands triplex pumps require in performing pressure washing operations. In the mid 1960s to early 1970s Italian and Japanese firms developed and subsequently mass-produced affordable compact pumps. They were, for all purposes quite similar to their big brothers, operating at 25–150 hp., featuring a V. packing design, ceramic plunger sleeves, caged plate valves, manual pressure regulation combined with a pressure relief function for manual trigger-gun operations (avoiding the dump-gun service), controlling water usage and undesirable side effects. At this time engine manufacturers including Briggs and Stratton (Fig. 1.117), Honda (Fig. 1.118), Kohler (Fig. 1.119), Kubota, etc., developed suitable engines (5–20 hp.) by taking into account the operational rigor reciprocating pumps may undergo within a service application. This engineering and design event facilitated adequate pump drives, revolutionizing the new-age pressure-washing industry.

Some ask why hydro-blast equipment manufacturers were slow to respond or passive to the existing pressure-washing market. One answer is that they actively pursued the complexity of the emerging industrial potential in operating above 25–150 hp, providing application specific water volumes and tool combinations (interchangeable piston-plunger combinations). Or, one can also theorize that within the constant quest to produce higher pressures and water volumes above 25 hp. (capping out in the mid 1960s at 150 hp), application varieties below 25 hp. were all of secondary interest and only important to service providers capable of operating multiple hydro-tool combinations of one triplex pump in a specific job environment. I speculate that service providers and manufacturers alike did not anticipate an adequate amortization or return on their investment in emerging markets at 2–5 gpm and 1,500–5,000 psi. This is most surprising considering the vast amount of jobs available within this performance criterion.

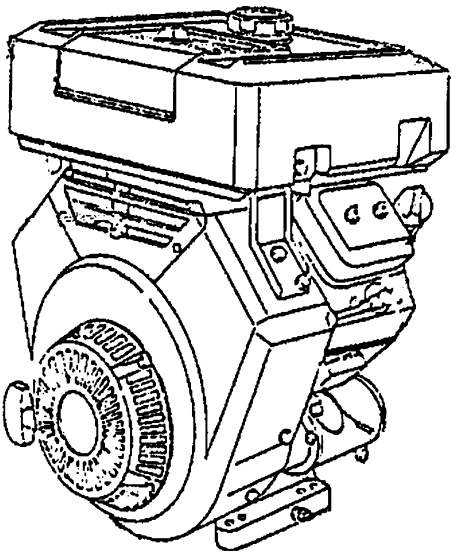


Fig. 1.118 Honda

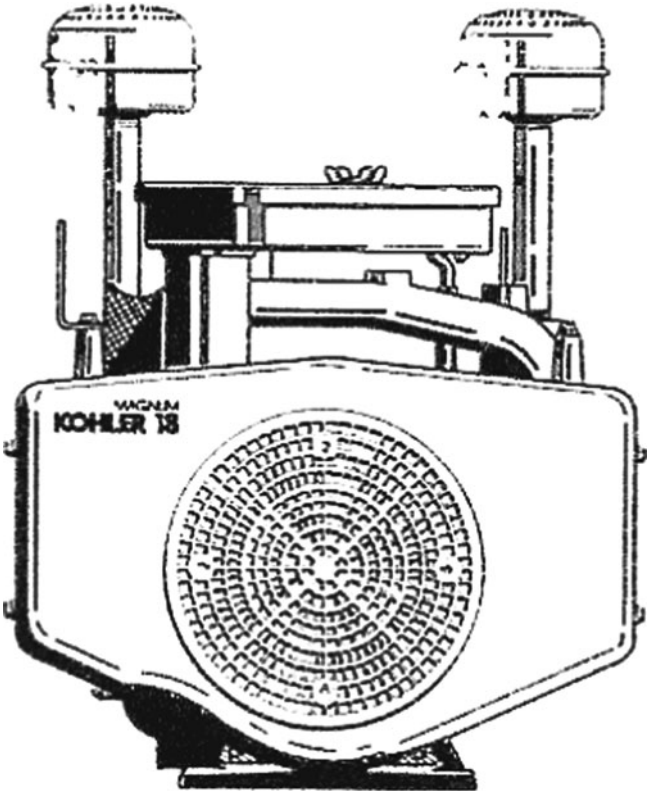


Fig. 1.119 Kohler

Fig. 1.120 Prison facilities

This was not the case with steam vapor-hot water equipment manufacturers who understood the added application advantages in the commercial service-cleaning industry. Incorporating or outfitting the available hot water or steam technology with these pumps (5–18 hp.) resulted in a variety of high-pressure water-steam equipment combinations, followed by the birth of the modern mobile and stationary hot–cold water pressure-washer and systems (1,500–9,000 psi).

The successful downsizing of existing hydro-tool varieties (5–10,000 psi) was also of benefit to service companies. Today, the industry supplies manually adjustable pressure regulators, pipe cleaning nozzles, abrasive injectors and tank cleaning heads, spin-jets for flat or vertical work, hp-gun-wand-flex lance combinations and their nozzle technology. Industrial vacuum heads-equipment, product separation techniques and up-down-stream chemical metering equipment, etc., accommodating gpm–psi ranges associated with the pressure-washing industry, were also modified and successfully applied. These events quickly created application marketability for cleaning private, commercial and industrial environments.

In the USA, leading equipment manufacturers (1,500–5,000 psi) with foresight, at their own time and expense, accelerated the design and development of closed looped water recycling-filtration-evaporation and reverse osmosis systems. These systems are today readily available in stationary and mobile form, supporting the service industry's application marketability, in particular where environmental constraints and liquid waste disposal regulations require detailed attention.

The food service industry established compliance requirements regulating fire hazard control, air quality-temperature and food safety within the transportation, produce-storage-handling and assembly areas, identified as produce receiving area, cold-storage, refrigerated walk-in facilities, product prep-rooms and kitchens. These requirements are well documented and competing service providers should familiarize themselves with them. In their constant daily routine and effort to eliminate the introduction of food borne illnesses and possible fire hazards, restaurant owners, chefs and custodial management in institutions such as prisons (Fig. 1.120), healthcare organizations, schools and corporate kitchens expect service providers and their labor force to submit appropriate certification in

Fig. 1.121 Fast food industry

kitchen exhaust cleaning procedures. This includes incorporating the practical relevance or variety between cleaning and sanitizing objectives, correct waste removal practices and if necessary, implementing closed looped water-refuse filtration recycling methods. Alkaline-detergents-acids-solvents-disinfectants their implementation-concentration and neutralization within a job requirement must be governed by health department's sanitary guidelines and FDA approved. Product containers must visually identify contents by displaying up-to-date material safety data documentation (MSDS). Jobsite access where nonessential personnel traffic could occur may also require this visual warning or identification of hp-washing operations and potentially hazardous products in use. As for over the road transportation, MSDS documentation must identify and accompany chemical-powders and liquids. Drivers must display a visual warning-identification sign on the back of the vehicle in question.

For the most part, within their business-theme and on their premises, the fast food industry (Fig. 1.121), designed and developed exhaust hood-duct and fire prevention equipment to better facilitate services and cleaning procedures. Services and oil-grease removal-pickup schedules are determined by operating time and the product volume manufactured. They further present a wide variety of job opportunities. Their premises require periodic attention, which could include cleaning restaurants drive-thru (flat work), exterior customer window assemblies, parking or pedestrian areas, children play facilities, produce receiving areas (loading docks), garbage-refuse locations and dry storage surfaces. Oil recycling areas and equipment, which can include an incinerator environment in need of services, or graffiti removal applications, are all further possibilities for a contractor.

State and County health and fire departments are not yet nationally unified in a standardized inspection curriculum for restaurant hood-duct systems. The decision to incorporate adequate cleaning intervals is mostly left to the judgment of facility operators. Therefore, commercial duct-hood cleaning-sanitizing schedules and their service complexity may vary drastically between business locations and their

Fig. 1.122 Fire extinguishing-suppression equipment

Fig. 1.123 Denatured fat contaminated surfaces after cleaning

management. Today, they can prove in large measure similar in intricacy to hydro blast operations. This is in part due to cuisine variety, product volume, type of cooking oil-fats-moisture and temperature utilized in the production process. Furthermore, exhaust systems efficiency, oil-grease filter type (grease removal devices), the design of fire extinguishing-suppression equipment (Fig. 1.122), their location and a duct systems age-structural integrity or accessibility are all constantly changing factors playing a part in these challenges.

Chemical applications within a kitchen (approved acids, solvent, soaps) and the wide variety of high-pressure water tools, their jetting characteristics manipulating oil-grease or denatured fat contaminated surfaces (Fig. 1.123), demands effective tarpaulin-covering procedures (splash proofing) to minimize and direct water-refuse overspray into the nearest containment area, always keeping food safety

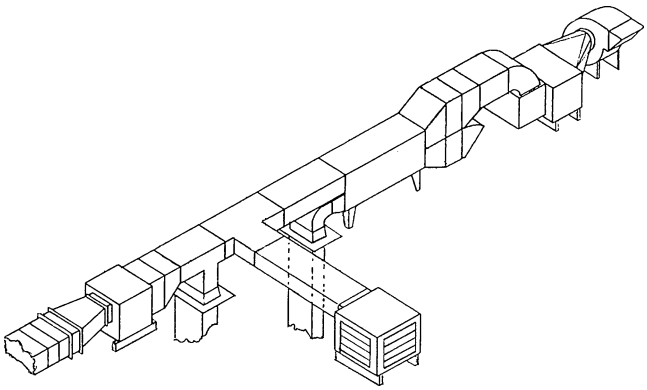


Fig. 1.124 Roof duct installation and fan assemblies

regulations and overall cleanliness in mind. This requires practical experience and incorporating application oriented flexibility within every encountered jobsite.

Incomplete or mediocre cleaning procedures may also present a liability factor to a service provider. Most hood-duct fires are due to burning foodstuffs. According to state-county enforced fire codes, when performing grease extraction procedures on hood canopies, grease-traps, grease filtration-extractors and their kitchen exhaust duct system, including duct risers, roof installation and fan assemblies, a service provider must be properly trained, certified and qualified to recognize different types of commercial kitchen exhaust systems and components (Fig. 1.124). Identifying a noncompliant system, often found in older establishments (grandfathered), and when restaurant ownership changes sporadically, demands proper recording-reporting of non compliance for tool inaccessibility, blind spots and possible oil-grease leak or pooling situations. In short, reporting the overall status before, during and after a system is serviced is a requirement. With proper technical authority, this may also involve the installation of grease proof, air, fire and water tight service access doors to inaccessible areas of a system. Basic plumbing, sheet metal fabrication skills, knowledge of electrical circuitry and performing lockout-takeout measures is a necessary prerequisite. The contractor is expected to test the system after job completion, guaranteeing and making ready for proper functionality before any restaurant activity or function continues. Training and employing an educated labor force is very important. Labor dress codes, safety and hygiene methods should also be responsibly guided and not seen as a negative criterion, rather as a necessary professional, safety oriented function, resulting in the customer's ease of mind and supporting management in their sales efforts. When scheduling services, take into account a kitchens natural operating and down times, which might include operations in produce receiving, storage and prep areas.

Having proper education and experience in ventilation control, fire-protection-prevention and or equipment supply industry for commercial cooking facilities offers further opportunities. This includes servicing and, if necessary, charging fire

Fig. 1.125 Food-produce retailers

suppression systems to guarantee their functionality and upgrading exhaust systems to current (NFPA) fire code requirements.

Technically well versed contractors or entrepreneurs can also expand their potential into the grease interceptor business. In general, their sizes are determined by product volume-usage and existing uniform plumbing codes or otherwise local standards. Externally situated, these grease interceptor units hold a minimum of 650 gallons plus effluent. Pumper truck employment (hydro-vac system) and possible microbial treatment procedures are of essence. Cleaning the air-conditioning system's (duct work) evaporation coolers, etc. is also an important facet.

Food-produce retailers (Fig. 1.125) offer obvious application varieties, starting with cleaning shopping carts, floor surfaces in produce receiving or warehousing facilities, refuse locations, pedestrian and parking areas. Employing the closed loop high-pressure water cleaning method is ideal, in particular in equipment service areas or suppliers-customer vehicle parking locations where dirt and oil accumulations are likely. Federal and most local laws will not permit the introduction of created effluent by pressure washing operations into the storm water conveyance systems. Due to the intensive use of disinfectants, harsh cleaning solutions, acidic produce, heavy human and equipment traffic, coating renewal or removal applications in warehousing, cold storage and produce display areas are also common job descriptions. Some retailers also operate in-house restaurant or kitchen style food service, requiring periodic hood-duct cleaning applications. Besides operating highly sophisticated computerized distribution centers, giant national supermarket chains often maintain bread, milk, cheese or ice cream manufacturing environments (Fig. 1.126) where standardized high-pressure water cleaning solutions are of necessity.

All food processing-manufacturing activities, including packaging, storage and transportation, are conducted under conditions and controls necessary to minimize the potential for growth of microorganisms or other possible contamination. The industries complying with these requirements monitor physical factors such as time, temperature, humidity, pH, pressure and product flow rates in manufacturing

Fig. 1.126 Dairying plant

processes such as freezing, hydration, dehydration, heat processing, acidification and refrigeration. The industries risk assessment for possible product contamination led to establishing critical control points (HACCP) throughout the manufacturing process. Plant cleaning schedules challenging suspicious food or edible product contact areas accelerated the design and manufacturing of stationary hot and cold pressure washer systems. They are placed in production facilities supporting sanitation standing operational procedures (SSOP). This fact does not add to or diminish the business potential for a contractor. Most service opportunities are created during production line shutdowns or product changeover procedures which can be seasonal or when starting up a new product line requiring cleaning of contaminated hardware components. In the food retail-processing environment a prerequisite might exist that the contractor's equipment or support tooling be designed to their industry standards.

The aspiring entrepreneur does well when realizing the type of energy and hardware applied within specific manufacturing processes. Boilers and steam generators, heat transfer equipment (condensers, heat exchangers), cooling towers, pumps, air compressors, their pressure and discharge product lines, water treatment facilities, refrigeration, freezer hardware and areas, are often the heart of a process environment. Bakery, candy, confectionery processes, beverage and cannery environments, dairy products, dressing and sauces, vacuum packed frozen-refrigerated fruit and vegetables, grain and cereals, meat, poultry or seafood products, snack foods, etc. are all manufactured with production equipment and areas in need of periodic services. Ovens and driers, precipitators, tanks, mechanical-centrifugal or bag house filtration units, accumulators, mixing-blending or fermentation vessels, product forming, sorting, grading equipment, packaging machinery or product conveyors are only a few equipment identities. It can be noted, as within the produce retailer's environment, that acidic activities of foodstuffs, thermal conditions and mechanical forces by loading equipment, etc. to floor coverings accelerates wear and tear demanding frequent removal and installation procedures of FDA-USDA

Fig. 1.127 2D nozzle carrier

Fig. 1.128 2D nozzle carrier extended

approved floor systems. Working with paint-coating installers can be a viable subcontracting possibility.

In the mid 1960s the first nozzle carriers with an automated rotary function were developed, operating at 7,000 psi delivering 36 gpm (Fig. 1.127) and pressed into industrial services for evaporator, tanks, autoclaves, rail tankers and tanker truck cleaning applications. Rotary nozzle carriers outfitted with various accessories drastically improved the industrial application potential. This type of equipment was engaged throughout the commercial, industrial and military sector, including smokestack maintenance (Fig. 1.128), sewer, horizontal-vertical

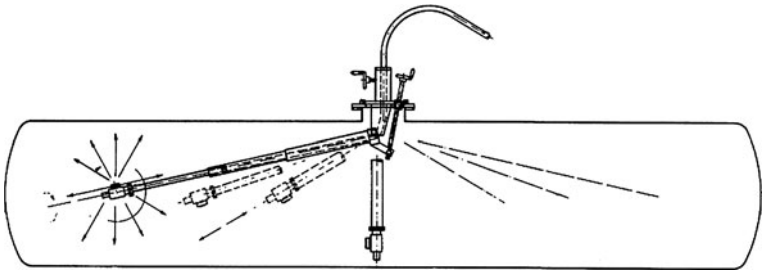
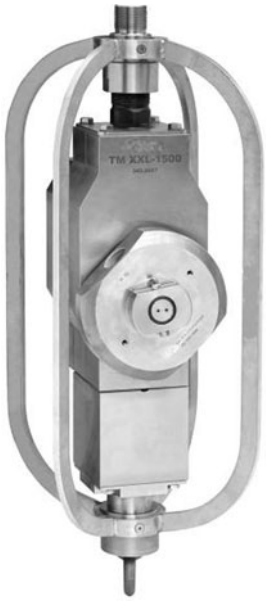


Fig. 1.129 Rail-tanker telescoping fixture

Fig. 1.130 3D Tank nozzle



industrial pipe cleaning operations, container and casing decontamination procedures (Fig. 1.129).

In the mid 1960s, the first high pressure 3D nozzles (Fig. 1.130) became functional, producing further enhanced cleaning methods, operating at 7,000 psi up to 89 gpm. This profound nozzle technology often eliminated the otherwise customary confined space entry method found necessary in square-round-elongated tanks or spaces by permitting water jets to reach all problem corners and areas. At that time, this type of equipment was temperamental, nevertheless, an industry benchmark in its performance criteria and today is an industry standard for performing cleaning and product scaling operations within most available low to high pressure gpm–psi ranges.

Since the conception of water as a tool, refrigerated trucks, trailers, tankers and railcars, the major movers of foodstuffs, have been cleaned with hot or cold

APPLICATION REVIEW

Customer, Company: Web site: e-mail:		Date: Nr: Address: City: State: P.O. Box: ZIP Code:	
Purchasing	Engineering	Maintenance	Safety
Tel: e-mail: Area:	Tel: e-mail: Area:	Tel: e-mail: Area:	Tel: e-mail: Area:
Job Description:			
Job Location:	Job Site Risk Assessment:		Specify:
Job Site Review:			
Safety equipment and procedures:			©
Food service industries, food retailing, suppliers, food processing companies, tanks, trucks, trailers, railcars, and mechanical equipment.			

WORKSHEET- PURCHASING - SALES

Fig. 1.131 Fleet washing

high-pressure water in one form or another. As well as mobile foodservice units, this type of equipment is today cleaned only by incorporating EPA (Clean Water Act), state and city guidelines, regulating industrial and commercial wash water discharges. The continued cleaning with high-pressure water and sometimes necessary chemistry, in rural and industrial areas, of trucks, trailers and for this matter all other mechanical equipment on unprotected permeable grounds, is deemed environmentally an unacceptable work method. This includes not only the illegal discharge of waste or wash-water to open ground-soils-gravel surfaces, but also into storm sewers and septic systems.

Regardless of the job in question, qualified and conscionable service providers will always first consider the possible environmental impact by the downstream blast water refuse. In these service areas, past inappropriate precautions resulted in gradually accumulatively developing leach fields containing high-levels of pollutants which contaminated surface-soil-ground-aquifers and subsequent well or potable water sources for decades to come. Responsible for this are the possible pollutants in turbid wash water. Liquid waste containing total dissolved solids in excess of 400 mg/l or containing a chemical oxygen demand in excess of 45 mg/l, detergents and materials causing foaming or frothing, acids or alkaline substances having a pH value lower than six or higher than 10., traces of emulsified oils-grease and/or toxins such as benzene, cadmium, chromium, toluene, mercury, copper, lead, metals, etc. must never be introduced to the separate storm water conveyance system. EPA, state, county and city drainage utility authorities under the national pollution discharge elimination system (NPDES) controlling storm water discharges from sites of industrial activity, prohibit all non storm water discharges to the municipal separate storm water conveyance systems. In researching all necessary regulations, a service provider is best advised to consider the closed loop non discharge cleaning method to avoid the obvious, but also possible implications resulting from past activities by unknown violator.

This no discharge reality, in itself, presents a terrific business opportunity. Fleet washing (Fig. 1.131) demands a high degree of trade flexibility. Engaging in weekend and night work, having emergency response capabilities and tooling

Fig. 1.132 Wash-water recovery

befitting the multitude of a fleet owner's equipment and location varieties, means maintaining a qualified labor force, planning and organizational skills.

A "one size fits all" equipment and tool selection must be viewed with skepticism.

Primary cleaning considerations are;

1. The type of road film encountered and remaining waste of previous products transported; 2. Vehicles or equipment purpose, seasonal circumstances, fleet location, scheduling requirements, location of possibly necessary electric power and water sources; 3. Ground, refuse runoff conditions or circumstances must conform to EPA, state, county-city-locality wastewater discharge regulations.

For the most part, variables will likely change between jobsites. Local municipal ordinances can also be more stringent than federal regulations and can include heightened discharge policies regarding sanitary sewer systems by limiting the liquid volume introduction (gpm) of non-hazardous wash water. Varying in cost, municipal waste water discharge permits can be a requirement regardless of the wastewater volume in question. Concentrating any liquid waste stream on a customer's site can result in a hazardous product. In general, only when service providers remove unidentified hazardous materials from a customer's location, will he become partially or fully responsible for the correct disposal of such materials. In addition to EPA and FDA regulations, most city and counties offer internet resources for non-storm water discharges, providing waste water treatment links. Some incorporate best management practices for mobile pressure washing services. Once these parameters are understood, qualified equipment and tool selections can be determined.

The savvy service provider will find professional products-tooling and chemical rinse aids specifically designed for closed loop wash water pickup (Fig. 1.132), incorporating removal of fine solids and pollutants such as oil and grease manipulated by vacuum, water filtration-recycling-compacting and/or possible evaporation methods. As well as fleet and equipment washing, justifying the investment in such equipment is a matter of the company's entrepreneurial growth and future potential. Mobile integrated mat and vacuum boom systems, sewer-pipe

APPLICATION REVIEW

Customer, Company: Web site: e-mail:		Date: Address: City: State:	Nr: P.O. Box: ZIP Code:
Purchasing	Engineering	Maintenance	Safety
Tel: e-mail: Area:	Tel: e-mail: Area:	Tel: e-mail: Area:	Tel: e-mail: Area:
Job Description:			
Job Location:	Job Site Risk Assessment:		Specify:
Job Site Review:			
Safety equipment and procedures:			©
Kitchen hood canopies, air duct exhaust cleaning, grease filtration-extractor services, fleet washing, and drive-thru's.			

WORKSHEET- PURCHASING - SALES

drain covers, tarps, wet-dry vacuum equipment with an internal sump-pump function, converting pressure washing-hydro blasting equipment to hydro-vac technology and most importantly, choosing job specific tooling-essentials, keeping application flexibility in mind, enhances the contractor's application potential and overall marketability. Most equipment can be utilized for disaster cleanup or servicing parking garage facilities, gas stations, bank drive-thru, building restoration work or, for instance, in general area decontamination of crime scenes and accident sites, floor and equipment services in machine shops, warehouse facilities, and in most other in-house surface cleaning operations.

Contacts. Hotels, restaurants, institutions, food-produce retailers, food processing-manufacturing, process engineers, maintenance-services, purchasing departments, product transportation environments, their purchasing-maintenance personnel or facility managers.

Resources. Refrigerated Transportation and Warehouse Association, http://www.IARW.com, Areas "Food Processors Association," for possible customer info, http://www.mwfpa.org. Internet; "Storm water management and discharge control", Best management practices for mobile cleaning", EPA, state, city or county wastewater discharge departments, local fire departments for existing regulations and fire prevention codes (restaurants), etc.

Safety. FDA, and OSHA regulations within the specific commercial or industrial environment.

1.17 Foundries, Steel Mills, Forging Shops, Nonferrous Metal Industries, Pelletizing (DRI) Plant

Some consider the hydraulic mining method the first high-pressure water application within the mining and metals industry.

That is highly debatable, considering the prerequisite of an industrial pump, wire braided reinforced hoses, suitable 4,000 psi plus pressure gauges and high-pressure water a. tools, all of which had not yet been developed. The washing and removing of ore from a prospecting site by a concentrated high-volume low pressure water jet ended as a controversial mining technique. First by gravity flow, later by steam engine-pump combination, developed water pressure and on the hillside manually operating mounted nozzle contraptions provided the mechanical force. Some applied Bernoulli's nozzle design criteria, expediting dislocation of mineral aggregate in the millions of tons, leaving much of the affected environment in shambles. In the early 1900s, quench procedures performed on red hot metal surfaces applying a thermal shock with water (spray bar over rolling stock) is also referred to by some as one of the early high-pressure water application techniques. Again, this is suspect as this technique did not represent a new method

Fig. 1.133 **a** DRI plant, **b** Smelter, **c** Foundry

of slag scale removal within the industry (Fig. 1.133). The notion that anyone in the 1800s to mid 1900s produced the necessary psi and gpm configuration has never been confirmed. What's more, today it is known that high-pressure water methods, including UHP performances present certain limitations in removing such slag.

In 1956, at his father's business location, Wolfgang Maasberg developed the fundamental equipment identities for WOMA Corp., promoting and manufacturing high-pressure water tools operating within the 75–150 hp. range. Applying high-pressure water above 5,000 psi at various gpm performances within foundry, non-ferrous metal smelting and refining industries developed more or less by chance. Situated in Duisburg Germany, the heart of not only intense coal mining, iron foundries, nonferrous metal smelting and refining operations but also the cargo industry with their Rheine-Ruhr river ship yards, did encourage tool design criteria for these industries. Able to apply his newfound technology, which he coined "water as a tool", and equipment identified as "ATÜMAT" supporting these tools, delivering correctly the all important application oriented water volume-pressure configuration, he introduced hydro-blasting or water jetting techniques to these industries. In Germany in 1958, water blast techniques performed by WOMA for foundry processes supporting the mold recovery, shake-out, shot blasting and mechanical core removal application in large motor castings with various interchangeable hp-gun lance extensions, were not transferable to the Japanese market. Kobe and Kawasaki steel works therefore automated (1964–1968) their engine casting division by remotely controlling high-pressure water guns. Impacting casting sand and filaments within a cast motor block (Fig. 1.134) on a remotely controlled rotary platform, providing a successful cleaning procedure was then an astonishing achievement and not thought of by burly hydro-blast operators. Damage control to casting from knock out procedures, such as chisel, shot or abrasive techniques, reducing the caustic solution and disposal costs, operating in a dust free environment and permitting the recycling of core and shell materials was an obvious benefit. Yet, this method, protecting the operator behind a glass screen or better, in an operator cubicle was later downsized to support the development of enclosed automated casting cleaning systems, "CASTÜMAT", providing similar attributes Fig. 1.135.

APPLICATION REVIEW

Customer, Company: Web site: e-mail:		Date: Nr: Address: City: State: P.O. Box: ZIP Code:	
Purchasing	Engineering	Maintenance	Safety
Tel: e-mail: Area:	Tel: e-mail: Area:	Tel: e-mail: Area:	Tel: e-mail: Area:
Job Description:			
Job Location:	Job Site Risk Assessment:		Specify:
Job Site Review:			
Safety equipment and procedures:			©
Sand and core removal, machine shop cleaning, washroom services, sewer and pipe cleaning, gas flue cleaning, electro static precipitator services.			

1.17.79 **WORKSHEET- PURCHASING - SALES**

Fig. 1.134 Cleaned engine castings

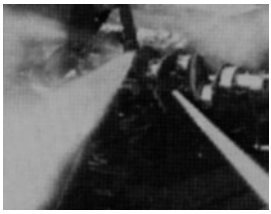


Fig. 1.135 Casting sand removal

Fig. 1.136 1963 Sewer cleaning nozzle

In mid 1958, adding a substantial power capacity (75–150 hp) to the newly developed sewer jetting technology proved especially successful when cleaning blast furnaces horizontal and vertical gas flue systems having diameters of 5′ plus. Sewer jetting heads incorporating crudely drilled nozzle orifices were exchanged for a nozzle carrier arrangement integrating individual, exchangeable hard-hitting nozzles (Fig. 1.136). Designed and guided by Bernoulli's strategy for compressing, accelerating and focusing a fluid jet over the longest possible standoff distance penetrating adhered scale or refuse proved successful. These nozzle carrier designs also accommodated encountered pipe circumferences (Fig. 1.137) to deliver the necessary gpm performance to drag in or lift the high-pressure hose assembly while cutting and flushing debris. Besides the emerging nozzle carrier technology, hoses providing the necessary gpm performances when operating at 5,500 psi plus ushered in the high-pressure cleaning era for large industrial pipe and tube cleaning applications.

It can also be noted that debris accumulating in designated or accidental waste collection areas permitted the first employment of hydro-vac systems, still in their

Fig. 1.137 Low profile sewer nozzle

infancy, but proving extremely effective in the pickup of dislodged refuse, water separation and filtration or product pumping and lifting capacities over vertical elevations of 60′–90′ feet plus.

The iron and steel making process usually starts with converting coal to coke, also called coking. Baking coal in a battery of large coke ovens in the absence of air preventing combustion, will release a variety of volatile byproducts and chemicals including tar, light oil, ammonia-ammonium sulfate, sulfur-sulfuric acid and others. In the past, the by-products and chemicals were of high value but are today more economically manufactured using such technologies as those of oil refineries. Some of these byproducts are recovered to power waste heat boilers (coke oven gas, light oil, etc.), converting energy to high-pressure steam, in turn generating electricity, otherwise likely rendered harmless by an expensive pollutant control and recovery system. The byproduct recovery plant area and its process equipment such as tar separator units, electrostatic precipitators, wet-dry scrubbers, the tar and liqueur plant equipment, still-tower and ammonia scrubber systems or waste water treatment facilities are all standard location and equipment identities serviced by high-pressure water and-or pressurized emulsion or light oil blast techniques.

In the past, blast furnace operations in steel mills and foundries produced a multitude of product, creating subsequent frequent processing difficulties. The resulting application variety is nowadays considered a standard in the service industry. Responding to these applications requires pressures ranging from 3,000 to 45,000 psi at 2.5 to 60 gpm. Approximately 75% of the available application criteria can be managed within the 3,000–12,000 psi range at 2.5–36 gpm.

Services may include cleaning heat producers, boilers, converters, heat exchangers, sulfur condensers, kilns, gas pipes, steam or fog tunnels, blast furnace's air cooling baffles, filters, cooling towers (Fig. 1.138), stack and bag house units, water treatment facilities, etc. (Fig. 1.139). Sales departments (services) do well in identifying sub-industry's maintenance needs, which may vary from the primary metal manufacturer's application criteria. Starting with the steel pipe and tube divisions, to the aluminum, copper, zinc, titanium, nickel and lead divisions, an extensive application variety can be mobilized.

The pressure washing contractor also offers his services to this industry's giant open pit mining operations which are generally located in faraway desolate areas. Numerous application possibilities exist permitting a gradual introduction to

Fig. 1.138 Foundries cooling tower

Fig. 1.139 Water treatment facility

industrial services by cleaning colossal mobile plant equipment, interior machine shop areas or exterior maintenance yard facilities which can include bath-house conveniences, interior or exterior office structures, dust removal and pasting applications, servicing field laboratory environments, visitor center and so forth. Due to the physical locations of most mining operations, adding hygienic oriented cleaning methods to the available application palette is of great advantage when offering 3,000–5,000 psi cold or hot high-pressure water services. With disinfectants or chemical assist applications, especially when spin jets and water-refuse removal operations with vacuum capabilities are offered, application varieties can greatly be expanded for an existing or possible new customer.

Industrial service providers utilizing 5,000–14,000 psi high-pressure water equipment may also enter into the mining environment, especially where taconite rock, bentonite and-or limestone aggregate is produced and delivered to an on or off-site pellet plant. Pellet types manufactured are numerous and based on customer specs. Product change over procedures sometimes results in fouled equipment. In-plant services include cleaning concentrate's gravity spiral lines, disc

Fig. 1.140 Flew and bag-house renewal

filters, concentrate storage tanks and distribution units, product conveyors, various screens and vibratory machines, pellet kiln, burner and cooler assemblies, stacks, and bag house units, water treatment facilities and their settling tanks or ponds, pellet loading and transportation-rail identities.

DRI technology, providing the direct reduced iron pellets from iron ore (taconite aggregate) to the melting process, also offers an application variety. Cleaning DRI top gas scrubbers, cooling gas scrubbers, ejector stacks and flues, bag house equipment, etc. are common applications found throughout the industry.

Newly developed and changing manufacturing processes or the closure of many blast furnace operations in their existing locations are not necessarily product quality oriented activities. Blast furnace operation's smelting and refining iron ore, bauxite, copper, tin, scrap metal and in some instances, uranium ore, etc., have produced an indefensible pollution burden, forcing and accelerating an environmental control criterion, which today manages and guides the general ferrous and nonferrous metal manufacturing technologies. This also led in some areas to a decentralization of the steel industry and the development of so-called mini-mills, which are found in numerous rural areas. Mini-mill-plants (Fig. 1.140) make every effort to maintain the smallest possible footprint regarding pollution to the environment. Contract work includes cleaning of metallurgy stations, their fume-particulate filtration equipment and bag house units, centrifugal separators, flues and stacks, scrubbers, dust collection bins, water treatment facilities, soundproofing equipment and their voids, exterior and interior tank cleaning applications, heat exchanger services, etc. Plant operators monitor air quality for compliance during plant operation and cleaning schedules. Due to their rural location, pressure washing operations between 3,000 and 5,000 psi are common and not only performed within the interior of buildings or manufacturing areas, but often mobilized for external building and roof structure cleaning applications to maintain an aesthetic appearance befitting their rural environment. Exterior hot corrugated roof structures and walls are cleaned during plant operation with temperatures ranging from 90 to 160°F. Staging, rigging and access, scaffolding and operating man lifts while plant is in operation demand a tight collaboration with mill's safety planners and control personnel.

Bauxite mining and crushing equipment, washing or wet screening hardware, bauxite transportation-rail and shipping identities require general pressure washing

and hydro-blast services up to 8,000 psi. Plant hardware in alumina refining operations such as digesters, filters, precipitators, rotary kilns and the calcination equipment producing the hydrate for the aluminum smelting process can require in or on some equipment, water pressures up to 40,000 psi. Modern primary aluminum smelting operations manufacture a variety of specialty alloys integrating not only iron, silicon, magnesium and their alloys, zinc and zinc alloys or copper, etc., but also blend recycled aluminum into their final product composition requiring prior stripping-cleaning and possible paint removal processes. Regardless of the foundries' melt process, type of energy consumed or type of furnaces in place (electric arc and induction, crucibles, iron foundries cupolas, etc.), scrap and bone yards supplying a specific metal grade or scrap waste to the melting process also depend on high-pressure water for maintenance solutions. Today cleaning equipment in scrap metal production facilities which control emissions from shredders, combustion facilities, their particulate scrubbers, bag house systems and flues, tanks and storage facilities for volatile and toxic substances or their areas, is of essence to any modern scrap yard operation. The effective guidelines and continuous controls to prevent air and soil pollution or excessive emissions when in the dismantling, burning, grinding, compacting, storage and transportation processes are tightly regulated by state and-or the EPA. Soil-earth remediation is also an operational aspect service providers should make available to this industry. Hydro-blast equipment with a few tool add-ons and filtration-chemistry is most cost effective in these operations. Aluminum smelting is an electric, energy intensive process offering power-washing and hydro-blasting marketing opportunities in nearby hydro electric, coal, natural gas or nuclear power plant operations.

Contacts. Purchasing and maintenance superintendents in steel mills, forging, foundries and Pelletizing plants. Mining engineers supervising construction or plant operations and processing facilities. Purchasing, engineering and maintenance departments for gravity-evaporation extraction, leach plant, solvent extraction and the treatment for the plant process water. Manufacturers of plant hardware for emission control equipment such as precipitators, scrubbers, bag house units, etc. Purchasing, maintenance and emission control department in scrap and bone yards.

Resources. The Steel Manufacturers Association, representing primarily electric arc furnace producers and operating mini-mills, http://www.steelnet.org, American Iron and Steel Institute comprised of producer member companies and suppliers to the industry, http://www.steel.org, On the Internet: Iron scrap, bone yards and the general recycling industry. CISPI member directory, pipe institute, http://www.cispi.org.

Safety. Steel mills, steel pickling facilities, foundries and nonferrous metal industries utilize or produce a variety of hazardous gases, fluids, fugitive dust and toxic substances which can be found in confined spaces or open areas and on contaminated plant hardware (coke oven gases, hydrochloric acid, chlorine, sulfur, phenols, fuels, etc). Study the National emission standards for hazardous air pollutants for integrated iron and steel manufacturing facilities (NESHAP) 68 FR 27646. Traffic hazards by heavy mobile industrial equipment, including overhead

APPLICATION REVIEW

Customer, Company: Web site: e-mail:		Date: Nr: Address: City: State: P.O. Box: ZIP Code:	
Purchasing	Engineering	Maintenance	Safety
Tel: e-mail: Area:	Tel: e-mail: Area:	Tel: e-mail: Area:	Tel: e-mail: Area:
Job Description:			
Job Location:	Job Site Risk Assessment:		Specify:
Job Site Review:			
Safety equipment and procedures: ©			
Gravity spiral line cleaning, pellet kiln services, gas scrubber cleaning, tank cleaning, pickling facility cleaning and soil remediation services.			

WORKSHEET- PURCHASING - SALES

cranes, high heat areas, below and high above work locations with or without unwarranted heat-dust-fume levels, or oxygen deficiencies, excessive noise or distances between contractor's equipment and job location, open unprotected electric and mechanical equipment, etc., are all factors considered when a bid walk is performed. It can be required that salesmen be trained, which can include a specific safety criterion in areas or process environments encountered in a specific in-plant job location. A contractor's crew submits to a plant safety awareness course, possible blood testing for existing lead-asbestos levels, etc. Further a safety meeting before work commences and a daily tailgate meeting of the crew should be the professional standard. A combination of safety controls and methods are always likely and coordinated with plant personnel.

1.18 Glass, Porcelain, Ceramic and Enameled Products Industry

In the early 1960s, the newly developed pressure washing and hydro-blast technologies were quickly custom tailored and introduced to plant maintenance requirements found in glass, ceramic and porcelain trade environments referred to as the non-metallic mineral product manufacturing industry. Long gone are the times where maintenance departments of production facilities creating table-flatware, cable-insulators, glass containers, kitchen and washroom or commercial window products delivered the bulk of cleaning services performed at 25–150 hp. Product volume requirements and the specific product oriented manufacturing process and its equipment utilized by glass fabricators, takes today advantage of incredible hydro-blast tool capabilities operating at pressures ranging between 3,000 and 55,000 psi.

Production facilities manufacturing flat glass, including industrial plate and architectural, glass tile-brick products, automotive glass, pressed and machine blown glass, light bulbs or television tubes and specialty products such as wire glass, textured glass, heat resistant glass, safety glass, glass fiber products, etc., support a multitude of application varieties geared specifically to the product and product change over procedure, eliminating most application identities past glass manufacturing processes required.

Services include cleaning of vitrification furnaces, ash furnaces, revolving furnaces and glass kilns, Penn-Vernon Drawing machine and equipment, down draw and re-draw process equipment, production molds, air blowers, heat exchangers, air-fume control equipment, conveyor and fabricator lines, storage tanks, sewer pipes, etc.

Today, the glass melt is prepared from pellets (Fig. 1.141) silica sand, lime, dolomite, soda and recycled glass waste. Besides silica sand (Fig. 1.142), large optics, precision optics, fiber-optic, specialty glass for instrumentation, commercial,

Fig. 1.141 Glass pellet feed

Fig. 1.142 Silica sand prep

analytical, laboratory and technical applications may also incorporate potash, lead oxide, zinc and a variety of other metal oxides depending on the product manufactured. The service provider must be aware of possible hazardous and/or chemically contaminated areas and confined spaces with oxygen deficiencies, possible hazardous-contaminated equipment which can include the utility water provided by plant maintenance being too aggressive (pH value), abrasive or otherwise chemically and/or bacterially contaminated requiring appropriate attention to protect the labor force and/or equipment operations. Generally, four types of air emissions are generated. Those from the combustion of fuel for operating the glass melting furnace and fine particulates from the vaporization and re-crystallization of materials in the glass melt and airborne or windswept particulate from storage facilities and transportation equipment and last but not least, from cutting, grinding and honing operations. Emissions generated provide an excellent business opportunity for commercial and industrial service companies utilizing an array of pressure washing and hydro-blast tool combinations. The pollution prevention hardware and control equipment or method differs due to product manufactured, the type and size of furnace encountered, fuel utilized and composition of the feed material. Not to worry, the emission control equipment is of standard commercial or industrial design, starting with exhaust blowers, smokestacks, flues and air ducts, centrifugal cyclone separators, bag house units, tanks, cooling towers, water treatment facility area and equipment, filter systems, evaporators, silt settling ponds, etc. The jobsite bid procedure and

APPLICATION REVIEW

Customer, Company: Web site: e-mail:		Date: Nr: Address: City: State: P.O. Box: ZIP Code:	
Purchasing	Engineering	Maintenance	Safety
Tel: e-mail: Area:	Tel: e-mail: Area:	Tel: e-mail: Area:	Tel: e-mail: Area:
Job Description:			
Job Location:	Job Site Risk Assessment:		Specify:
Job Site Review:			
Safety equipment and procedures: ©			
Exhaust blower, bag house units, smokestacks, flues, air ducts, tanks, cooling tower.			

WORKSHEET- PURCHASING - SALES

necessary safety methods demand prior identification of possible hazardous emissions, encountered hazardous products and/or accumulated total volume of generated waste within a service operation before the correct price, job procedure and labor safety requirement can be established. Main emissions may include sulfur oxides, nitrogen oxides and particulates which can contain heavy metals such as arsenic, boron and lead. Specialty glass can produce and release hydrogen chloride, hydrogen fluoride, arsenic, boron and lead from raw materials and must be considered specifically if the job requirement calls for raw material or waste removal practices.

Liquid effluent from float glass processes, coating and electroplating operations may also vary substantially. Therefore, on a prospective jobsites, the employer's labor department, regulating plant safety, engineering and laboratory personnel controlling plant environments and operations, which generally includes the wastewater treatment facility, will always provide the best or safest information base and criteria to a service provider. Purchasing identities sometimes miscalculate job oriented safety issues concerning a possible in-plant work order or services description.

The varieties of ceramic products machined or molded by industrial identities may also incorporate some metals within their structural composition. Companies applying high-heat, high-pressure and chemistry in their manufacturing processes always rely on water as a specific maintenance tool. Air pollution, effluent filtration-control equipment, waste water treatment facilities and equipment are the first line of any company's environmental defense and therefore of immediate interest to a contractor.

Today's manufacturing facilities for advanced ceramics or engineered ceramic products can be found in rural, urban and industrial areas. They produce armor protection systems (plating-fabrics), ceramic filters, membrane filters, ceramic coatings for military industrial and medical applications, or components for air frames, aircraft engines, power generation equipment, oil field equipment, fiber optics and optical lenses. Also and vital to contractors offering high-pressure water as a tool are manufacturers of ceramic capacitors, transducers, superconductors, etc., servicing the electronic industry. This is also accurate concerning facilities which manufacture enameled products. The enameller utilizes dense mineral powders and metals for his coating process, producing laboratory and industrial equipment, household goods such as kitchen and bathroom fixtures. Further, the ceramic-porcelain-tile industry, which can be of industrial or decorative nature, applying high heat processes utilizing industrial furnaces, driers, silos, conveyor belts, tanks, autoclaves, boilers, heat exchangers, etc.

Taking all this into consideration, the non-metallic mineral product manufacturing industry should always be seriously pursued by a service sales force. A contractor can offer his capabilities starting on the silica quarry production site (Fig. 1.143), to the glass recyclers' facility and the transportation environment to production facilities applying the high heat glass melt processes.

Contact. Glass Association of North America, http://www.glasswebsite.com. Product manufacturers, purchasing, laboratory, engineering, maintenance personnel, product specific manufacturing associations acquiring a customer base, air

Fig. 1.143 Silica grain sorting equipment

Fig. 1.144 Silica storage bins

pollution engineering and waste management control identities, mineral mining-quarry operations and their product transportation and storage facilities (Fig. 1.144).

Resources. Trade associations as the NGA—National Glass Association, http://www.glaas.org, GMIC Glass Manufacturing Industry Council, http://www.gmic.org, and includes automotive, Fiberglas, flat glass, glass container, hollow glass, optical glass fiber, pressed and blown glassware and safety glass manufacturers.

Safety. Due to the variety of manufacturing environments and diversity of energy, raw materials or chemicals utilized within the industry, a single set of safety recommendations for an external plant labor force is not possible. The environmental health and safety guidelines for the glass manufacturing environment, describing emissions to air, wastewater and solid waste is the best guideline and source besides the specific plant, plant area and product handling requirements encountered with every jobsite. This will likely be a requirement produced within a job description provided by purchasing and maintenance identities. Some applications require thermal protection gear, eye protection, confined space entry qualification, and so forth. Excessive long distances between a jobsites and equipment–equipment operator can be encountered. Most job applications require a combination of enforced in-plant safety requirements.

APPLICATION REVIEW

Customer, Company: Web site: e-mail:		Date: Nr: Address: City: State: P.O. Box: ZIP Code:	
Purchasing	Engineering	Maintenance	Safety
Tel: e-mail: Area:	Tel: e-mail: Area:	Tel: e-mail: Area:	Tel: e-mail: Area:
Job Description:			
Job Location:	Job Site Risk Assessment:		Specify:
Job Site Review:			
Safety equipment and procedures: ©			
Water treatment facility, settling ponds, evaporation beds, autoclaves, boilers, condensers.			

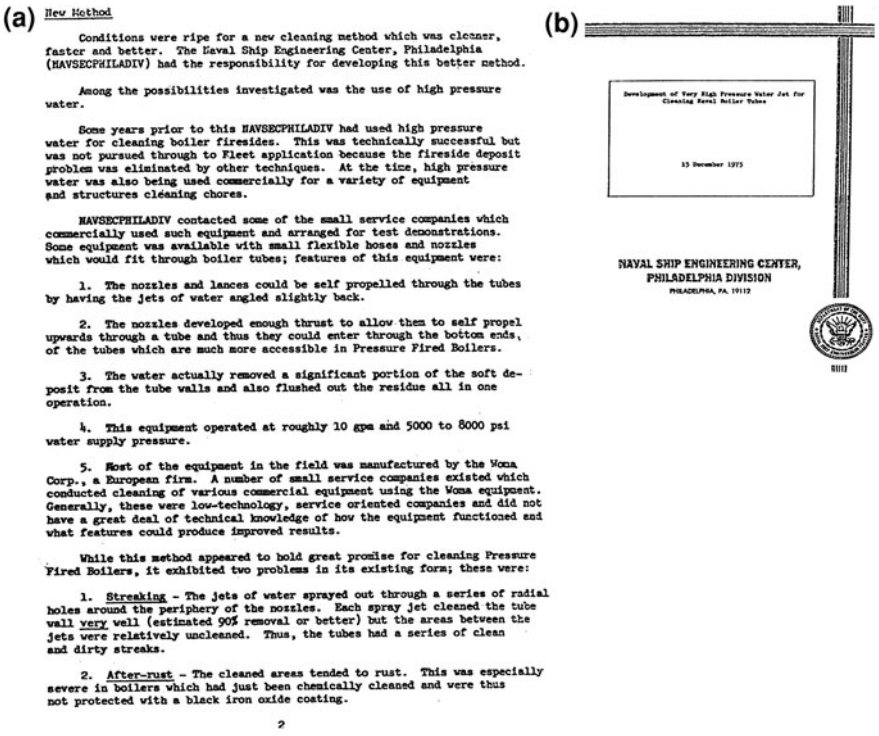
WORKSHEET- PURCHASING - SALES

1.19 Maritime Vessels, Offshore Oil Platforms, Shipyards, Harbor Facilities, Piers, Recreational Boating

In 1968, to support their growing customer base, WOMA Corp. of Germany established a subsidiary in Linden, New Jersey, introducing their products, hydro-blast techniques and services to the US market. At this time with sales, distribution and manufacturing facilities in over forty-seven nations the company felt at ease to undertake this endeavor. In the US the majority of foreign customers that were aware of cleaning with hp-water and its application varieties, a exploited this techniques first. The New Amsterdam, a Dutch liner for example, stranded in 1968 in the New York Harbor on pier 48, was such a customer. Her fouled boilers were cleaned on the fire, water and high-pressure steam side applying hydro-flex and rigid lance technologies. Power, steel, chemical and refinery plant identities servicing their equipment with high- pressure water in European, East and Far Eastern industries were to some extent also educated in the utilization of hydro-blast technologies. Abroad, in their subsidiaries, US refineries and chemical plants were already accustomed to industrial high- pressure water cleaning services for approximately a decade. In no small measure did this support the US industry and or initiated the rapid development of hydro-blast equipment and services by local engineers and industrial entrepreneurs calling b the technique "water blasting"…

As indicated in 1975 reports, US start-ups (Fig. 1.145a, b) encountered problematic equipment dilemmas. This included poorly functioning hp dump-gun designs, excessive pressure drops in hp-hose assemblies and nozzle designs creating internal streak patterns. The applied corrosion inhibiting technology also proved quite ineffective. Pump valve and/or packing failures appeared most likely when equipment operated over extended times above 8,000 psi. Notorious flaws in nozzle design criteria, pitiable machining processes, and little consideration to equipment-cleaning method, and created shortcomings application oriented gpm/psi configuration concerning hp-hose by poorly designed knock-off tooling and nozzle criteria and tool assemblies, which often failed to produce or replicate an expected cleaning rate or surface a appearance and more shocking, these nozzles are still peddled to the unsuspecting novice, reminding us of this not so happy hydro-blast era. It is also noted that a decade earlier, technicians flirting with similar problems in European and Far Eastern markets introduced a far more adequate, but no doubt more expensive design and manufacturing technique avoiding these obvious and in some cases, persistent problems.

Besides heat exchanger, condenser, boiler, ship-hold or tank cleaning applications, the superstructure or ship-hull above or below the water line was first manually washed or hydro-blasted with hp-guns applying fan-jets. Working from a powered platform on the ship-hull's water line (Fig. 1.146a, b) offsetting tools recoil forces produced the immediate b development of balanced underwater hp-guns which were then pressed into service by industrial divers (1959). The effective manual method quickly evolved into the practical application of rigid and


(a)

New Method

Conditions were ripe for a new cleaning method which was cleaner, faster and better. The Naval Ship Engineering Center, Philadelphia (NAVSECPHILADIV) had the responsibility for developing this better method.

Among the possibilities investigated was the use of high pressure water.

Some years prior to this NAVSECPHILADIV had used high pressure water for cleaning boiler firesides. This was technically successful but was not pursued through to Fleet application because the fireside deposit problem was eliminated by other techniques. At the time, high pressure water was also being used commercially for a variety of equipment and structures cleaning chores.

NAVSECPHILADIV contacted some of the small service companies which commercially used such equipment and arranged for test demonstrations. Some equipment was available with small flexible hoses and nozzles which would fit through boiler tubes; features of this equipment were:

1. The nozzles and lances could be self propelled through the tubes by having the jets of water angled slightly back.

2. The nozzles developed enough thrust to allow them to self propel upwards through a tube and thus they could enter through the bottom ends of the tubes which are much more accessible in Pressure Fired Boilers.

3. The water actually removed a significant portion of the soft deposit from the tube walls and also flushed out the residue all in one operation.

4. This equipment operated at roughly 10 gpm and 5000 to 8000 psi water supply pressure.

5. Most of the equipment in the field was manufactured by the Woma Corp., a European firm. A number of small service companies existed which conducted cleaning of various commercial equipment using the Woma equipment. Generally, these were low-technology, service oriented companies and did not have a great deal of technical knowledge of how the equipment functioned and what features could produce improved results.

While this method appeared to hold great promise for cleaning Pressure Fired Boilers, it exhibited two problems in its existing form; these were:

1. Streaking - The jets of water sprayed out through a series of radial holes around the periphery of the nozzles. Each spray jet cleaned the tube wall very well (estimated 90% removal or better) but the areas between the jets were relatively uncleaned. Thus, the tubes had a series of clean and dirty streaks.

2. After-rust - The cleaned areas tended to rust. This was especially severe in boilers which had just been chemically cleaned and were thus not protected with a black iron oxide coating.

2

(b)

Development of Very High Pressure Water Jet for Cleaning Naval Boiler Tubes

15 December 1973

NAVAL SHIP ENGINEERING CENTER,
PHILADELPHIA DIVISION
PHILADELPHIA, PA. 19112

Fig. 1.145 **a**, **b** Navy introduction to 1968 Hydro-blast equipment-cleaning method, and created shortcomings by poorly designed knock-off tooling and nozzle criteria

oscillating nozzle carriers (OCR) also designed and intended for street cleaning equipment and rubber removal by runway cleaning equipment.

Jetting equipment was first affixed to mobile crane or hydraulic staging (Fig. 1.147), gear operating from the pier side of a vessel or mounted to a miniature tractor in service on the interior of dry docks. Shipyards realized immediately the advantages of a fixed and distant controlled jetting device. In streamlining this application, it became obvious that a remote controlled nozzle assembly would be of an advantage by eliminating staging equipment and minimizing the labor force.

In a group effort WOMA engineers and an affiliate shipyard (1967–1971) designed a unit called MAGNOMAT (Fig. 1.148), operated by one man utilizing the ship's railing or shipyards crane. The bond of the nozzle carrier to the ship hull and offsetting the nozzles recoil forces while providing remote controlled mobility, guaranteeing the correct overlapping of previously cleaned surfaces, is achieved with three powerful electro magnets. An array of plastic sheeted wheels will provide the necessary nozzle standoff distance and remote steering necessity. Today the MAGNOMAT is still of interest, especially in washing or advanced cleaning situations where algae barnacles or general marine growth must be removed from hull surfaces. This avoids the contamination of lake or seawater by

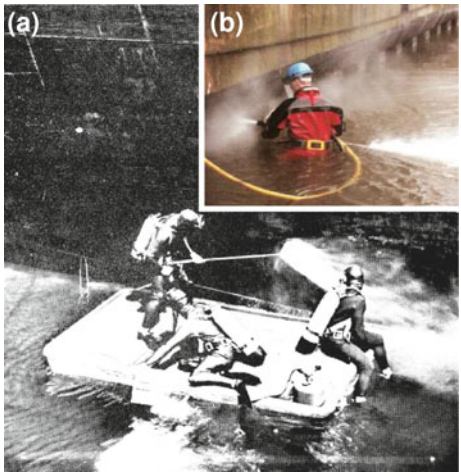


Fig. 1.146 **a**, **b** Offsetting tool recoil forces

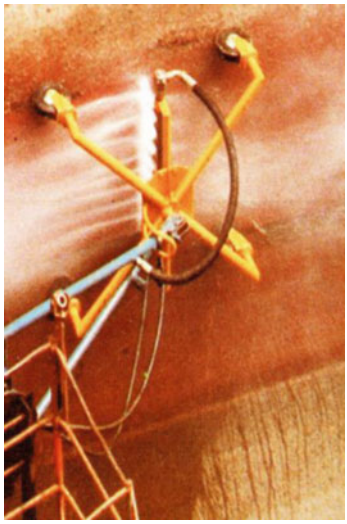


Fig. 1.147 Rigid nozzle carrier

eliminating within the cleaning process the introduction of paint chips, excessive rust or other scale deemed a contaminant to the water's environment. A 150 hp drive input produces up to 4000 yd^2 per hour. The hourly cleaning rate can be doubled by adding horsepower.

Today's coating removal equipment (Fig. 1.149a, b, c) may appear somewhat similar, but operational and technical comparisons can not be found. Vacuum gear blowers are responsible for equipment bond to hull surfaces and the subsequent controlled refuse transfer to a pier side or floating water filtration assembly. The

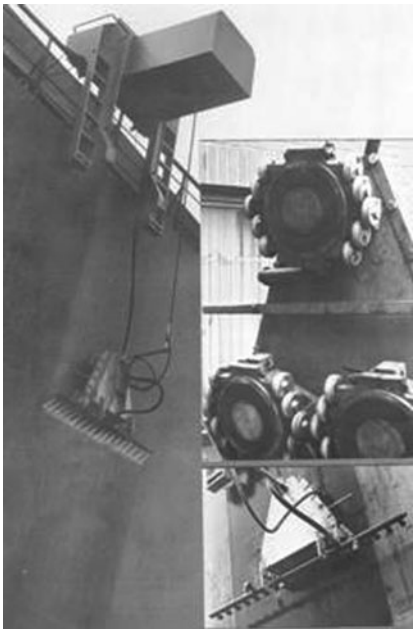


Fig. 1.148 Magnomat

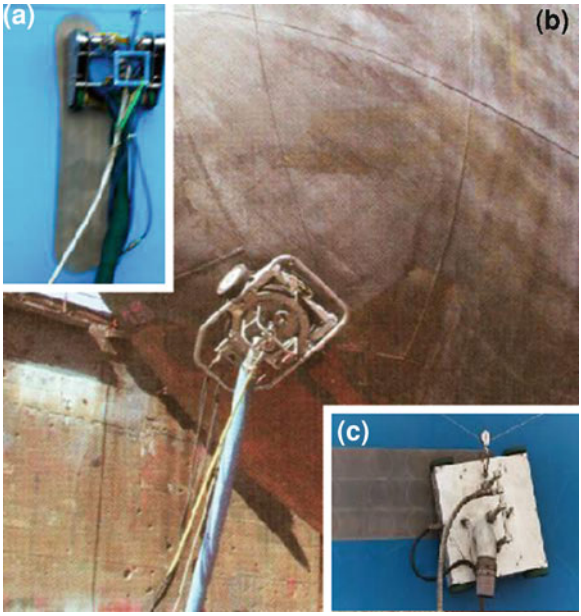


Fig. 1.149 **a–c** Various coating removal equipment

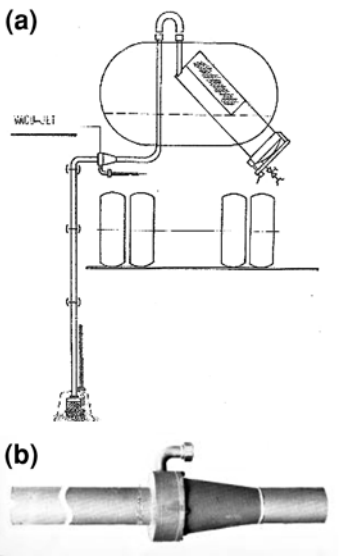


Fig. 1.150 **a** Wastewater separation, **b** vacuum ring pump

UHP vacuum Spin-Jet technology utilizing low water volumes for the coating and a rust removal process is replacing standard abrasive blast applications and earlier water-blast techniques common to spin-jet assemblies applying high pressure–volume water to remove paints, concrete surface slurry, etc. b The industrial low pressure, high volume rotary tank cleaning nozzles manufactured by companies such as Butterworth (1925) and Sugino in Japan can nowadays be found in most shipyards. High volume-high pressure rotary nozzles (5–22,000 psi.) are more or less in operation with manufacturers periodically cleaning their tank and autoclave vessels.

Contractors–-subcontractors will operate high-end mobile equipment in a variety of c industrial or commercial tank cleaning applications. With great success some service providers are also qualified to exploit the variations of hydro-vacuum systems within the maritime industry (Fig. 1.150a, b).

Developed for culvert and street cleaning equipment, the simplicity, unmatched performance and physical practicality on a jobsite is indisputable and its business potential totally underestimated. In oxygen deficient or enriched, b explosive, flammable or toxic atmospheres, this equipment provides superior functionality, ease of operation and decreased operating costs in comparison to equipment customarily put into service under similar job conditions.

Powered by high-pressure water at 7,500 psi, the “hydro-vac” component producing at any altitude continues maximum theoretical vacuum, consequently transferring super high air volumes (Cfm) throughout a vacuum system results in a specific job criterion which cannot be challenged by equipment powered by means of fan and mechanical vane or gear pump-blowers. Vacuum fan pumps (impeller)

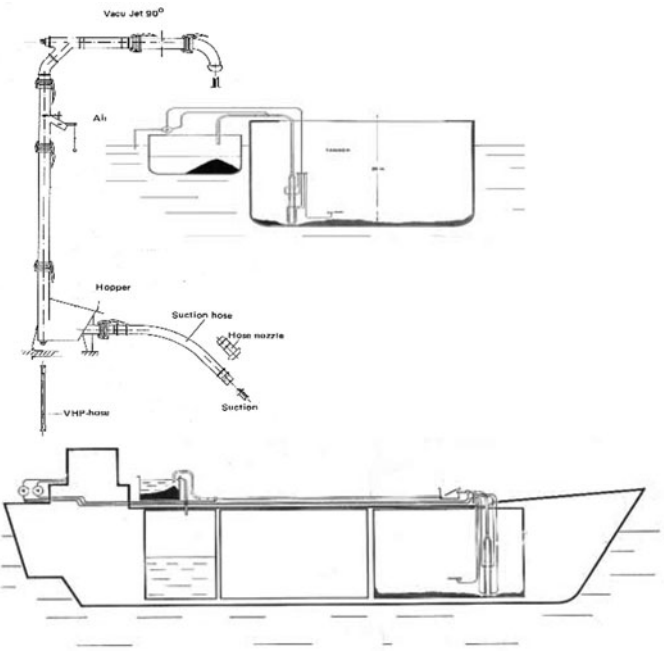


Fig. 1.151 Hydro-vac barge loading

are naturally restricted in vacuum performance. Vane and gear-blowers (direct displacement) quickly tend to wear and are more susceptible to performance reduction, most noticeable when operating in elevated altitudes. More importantly, they also generate tremendous heat on their internal meshing and exhaust surfaces which can be a notorious fire hazard by misinformed or unintentional incorrect work procedures.

Volatile or flammable, combustible and toxic products in liquid, viscous, gravel-rock like, granulated or powdered form are simply and cost effectively loaded while separated and filtered from transferring air or water to any degree desired. Mobile Vacuum-box containers designed to facilitate a maximum airflow throughout a vacuum system and operating at max-vacuum standard (32 Hg–10 m at 4,500–6,500 Cfm), taking into consideration various material separation and filtration techniques including HPA filtration, are nowadays custom manufactured and readily available nationwide.

Regardless of available hydro-blast or UHP equipment on hand, competent service providers must produce a multitude of trade certifications directly related to the marine environment. These certifications will permit bidding processes applying all available equipment identities utilizing pressure-washing or hydro-blast techniques. An incredible job variety is considered, therefore requiring a

Fig. 1.152 Equipment barge

complex tool selection or availability, substantial safety equipment and established verifiable safety procedures.

Service providers with rivers and lakes in their vicinity should consider the barge cleaning, repair and breaking industry. Often a barge must be cleaned between loading dissimilar cargoes (Fig. 1.151). The reasons can differ and be seasonal or production and product related and may involve the interior removal of trace chemicals, flammable or combustible liquids, dry bulk or powdered industrial-commercial granulated or gravel like materials. These cleaning or preservation requirements must not necessarily be performed in a dry dock or shipyard.

Mooring can be found adjacent to production or loading facilities, beached or at anchor and in lonely dock facilities situated in rural areas. A barge cleaning process can and will involve many hazards. The most important hazards are due to combustible, flammable materials, inhalation or by skin contact from inadvertent chemical exposure.

The flammable–combustible cargo barge cleaning process is the removal of the residual cargo by cleaning the tanks on the barge. OSHA guidelines are precise and involve pre-planning and preparing to clean, set-up for cleaning, cleaning and completion criteria, hazard communication, personal protective equipment and exposure limits, which should be evaluated throughout the barge cleaning process (Fig. 1.152).

There is much more to consider when identifying the cargo's remaining residue within a tank structure. Hopefully, this is verifiable through MSDS identification aboard the vessel (Top side mailbox) and includes the internal areas of product transfer pipes and inaccessible tank voids. OSHA also provides guidelines for the most typical hazardous barge cargoes found throughout the marine environment.

APPLICATION REVIEW

Customer, Company: Web site: e-mail:		Date: Nr: Address: City: State: P.O. Box: ZIP Code:	
Purchasing	Engineering	Maintenance	Safety
Tel: e-mail: Area:	Tel: e-mail: Area:	Tel: e-mail: Area:	Tel: e-mail: Area:
Job Description:			
Job Location:	Job Site Risk Assessment:		Specify:
Job Site Review:			
Safety equipment and procedures:			©
Heat exchanger, condenser, boiler, ship hold cleaning.			

WORKSHEET- PURCHASING - SALES

Preparing steel surfaces on the vessel's superstructure and hull for coating–painting procedures or removing specialty coatings, as for instance on submarines, is currently a routine application performed by contractors servicing naval and industrial–commercial shipyards. Remotely operated UHP crawlers or vacuum supported manually controlled UHP spin jet equipment and guns are commonplace. This should include abrasive blast techniques using hp-water above and below the water line. Service and sales forces often dismiss this straightforward tool capability. Often, while Hydro-blast services are conducted near hot work, performing specific limited structural changes or spot repairs to a hull or superstructure will require a final coating procedure. Prior to, or while services are in-house, the shipyard's purchasing, maintenance superintendent, including the vessel's chief mate, should always be made aware of the nearby capability. The need arising to produce or reestablish a necessary anchor profile can be lucrative. Often, the motivation to force an unsuspected work order is the negated or otherwise difficult job set-up procedure, arising air hazards and area contamination usually associated with abrasive air blast techniques.

To avoid typical suggestiveness or varying opinions on a steel surface condition before, during and after a water-blast or UHP procedure, the reference guide and photographs for "Steel Surfaces Prepared by Water-Jetting" developed by the society for protective coatings and NACE can be practical. "SSPC publication 0-1-05, NACE, international corrosion association item Nr.22016, ISBN1-889060-56-9."

The photographic guide is a valuable tool for any bidding and inspection process of a job criterion. Levels of cleanliness and flash rust of prior deteriorated multiple metal conditions and their final appearances are portrayed. This possible surface comparison is also important when considering various coating characteristics or their specific future installation methods. Coating manufacturers, coating inspectors, painters and vessel owners alike are most likely willing or accustomed to utilizing this visual guide. Confirming specific anchor profiles and reference surface appearances, before and after preparation by water jetting procedures, considering climate changes, application of possible chemical corrosion inhibitors, timing priorities for surface preservation, drying time and maintaining readiness for coating operations and their various applicator provisions is this guides support function.

Salespeople intending to sell services correctly must educate themselves to a vessels physical interior structure. Compartment or tank designation system and identification differs between industrial-commercial and naval vessels.

Navy vessels apply a three part number.

Example

02-116-2. First digit before dash indicates the deck level. Decks start at "0" being main deck, 01 level being first deck above main deck, 02s, etc. Single-digit 2 designates second deck below main deck level, 3 designates third deck, etc. The middle digits indicate forward most frame number of the compartment. The third digit indicates side of the vessel, 2 = port side, 1 = starboard side.

The Navy method for identifying compartments is also a three part number.

Example;

B-10-3 F. The first letter designates part of the ship, A = forward of the engine space, B = engine spaces, C = aft of engine spaces. Second series of numbers indicate the number of tanks in that area of the ship. The third indicates the type of product that space is used for, and whether the tanks are located (2) portside or (1) starboard side. F = for fuel oil, W = water or ballast, J = jet fuel, L = lube oil.

The commercial method normally identifies frames numbered from forward to aft, except some tankers in reverse.

Tanks and spaces are also numbered from forward to aft;

1 cargo hold, # 1 double bottom. Tanks are also marked port, STBD or centerline, # 2 doubled bottom port, # 2 double bottom center, # 2 double bottom STBD. Generally, compartments are not numbered, but designated by their function as engine room, steering gear room, anchor chain compartment, etc Fig. 1.153.

When offering to clean or perform surface area preservation, a salesperson must take into consideration necessary safety procedures within any specific location, configuration and description of the interior, possible restrictions to physical movement and so forth. The onboard competent person's practical job experience and know-how within a specific area must be considered and never underestimated. Adapting hydro-blast tools to tank and cargo hold (Fig. 1.154a) configurations demands close working relationship with either the equipment manufacturer's engineering department or a distinguished supplier specialized in providing custom accessories, enabling tool operators to reach all essential areas deemed necessary in surface preparation. Cleaning double bottom framing, longitudinal girders, their angles and brackets, or the interior of forepeak, deep, settler, bunker, day, after peak and potable tanks, heating grids in fuel oil tanks, surfaces in anchor chain rooms, bilge wells, shaft alley, cofferdams and so forth are the job descriptions a contractor will pursue. In general, when working in these confined areas a service provider must be able to read and calibrate oxygen deficiency meters and accurately measure combustible gases, handle the instruments with appropriate care, be proficient in managing and training the labor force in the correct use of air supply equipment, continuous flow respirators, pressure demand respirator with egress unit and general protective respirator equipment. Often safety belts, harnesses, lanyards, drop lines and lifelines are essential. Their use and condition is guided by the National Safety Council's standard. Most often, hydro-blast personnel will work alongside multiple job descriptions performed by other crews and are not related to either their company nor within their specific job description. It is very important, that hydro-blast personnel are independently capable to ensure that their workspace is at all times adequately ventilated, maintaining a gas free and oxygen sufficient condition. There is an established criterion for the correct ventilation (Fig. 1.154b, c) for double bottom tanks, cargo hold, barge tank, tanker cargo tanks, fan and duct arrangements, etc. Specified are the correct installation procedures of air supply and exhaust hoses and necessary explosion proof equipment. Explained in detail are the prevention tactics for an

APPLICATION REVIEW

Customer, Company:		Date: Nr:	
Web site: e-mail:		Address: City: State:	P.O. Box: ZIP Code:
Purchasing	Engineering	Maintenance	Safety
Tel: e-mail: Area:	Tel: e-mail: Area:	Tel: e-mail: Area:	Tel: e-mail: Area:
Job Description:			
Job Location:	Job Site Risk Assessment:		Specify:

Job Site Review:

Fig. 1.153 Vacuum-assist coating removal

Trade Related Publications:

16. The Society for Protective Coatings (2001) Paint Film degradation, mechanisms and control, failures related to particular substrates SSPC, [l6.28.407]
http://www.sspc.org

18. The Society for Protective Coatings (1992) Maintenance coating of weathering steel, field evaluations and guidelines, [l6.28.407]
http://www.sspc.org

Safety equipment and procedures: ©

UHP abrasive blasting, coating-paint removal on superstructure.

WORKSHEET- PURCHASING - SALES

Fig. 1.153

incomplete air circulation or dangerous recirculation of exhaust air and or short circuiting of exhaust air, possible also by the obstruction of designated escape routes by venting hoses and equipment such as fans, air-compressors, and Venturi blowers ventilating the hazard away?

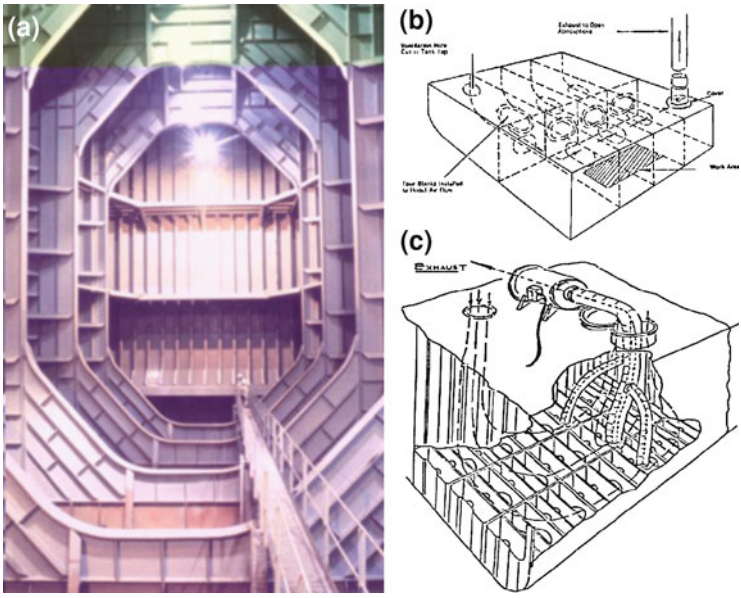


Fig. 1.154 **a** Cargo hold, **b** + **c**, tank-vessel exhaust plan

Proving operational proficiency in naval or commercial shipyards on piers supervised by Coast Guard and OSHA guidelines is a must. Enforced or established safety and Health regulations designed for the shipbuilding, ship repairing and ship-breaking industry is the criteria. Various certified companies however have their own set of competence; a standard based on an approved task analysis and/or any set of performance criteria specific within a pressure-washing or hydro-blasting job description and includes the step in–out procedure to the work location. Successful service companies develop a contracting strategy based on pre-qualification by achieving an approved contractor status with prospective customers. Verifying competence for an entire crew, a contractor bidding on annual job descriptions, covering all stages of a contracting cycle can be taxing and must be routinely validated by management. Contractors hiring a labor force should also be very diligent in proving or verifying the individual competency status in checking IDs and the origination of certifications. Job planning and establishing a permanent location for hydro-units and support equipment, such as vacuum box containers, trucks, tooling and safety equipment can only be executed by coordinating with the shipyard's designated supervisory staff. Fire department personnel will provide designated hydrant water supply and permit. Dry dock operations may vary due to traffic and equipment applied.

In naval and commercial yards, a vessel's owner, captain or chief mate and shipyards NFPA certified marine chemist will most likely control or confirm the contractually stated and applied technique to adequately discharge the treated hp-wash waters (Figs. 1.155, 1.156). Contractor's designated competent person

APPLICATION REVIEW

Customer, Company:		Date: Nr:	
Web site: e-mail:		Address: City: State:	P.O. Box: ZIP Code:
Purchasing	Engineering	Maintenance	Safety
Tel: e-mail: Area:	Tel: e-mail: Area:	Tel: e-mail: Area:	Tel: e-mail: Area:
Job Description:			
Job Location:	Job Site Risk Assessment:		Specify:

Job Site Review:

Fig. 1.155 Onboard coating removal

Trade Related Publications:

19. The Society for Protective Coatings (20002) Surface preparation and cleaning of metals by Waterjetting prior to recoating, Joined surface preparation standard SSPC-SP 12/NACE No. 5, http://www.sspc.org [l6.28.407]
20. The Society for Protective Coatings (20004) Supplements to systems and specifications, SSPC painting manual volume 2, cleaning metals by Waterjetting, surface cleanliness requirements, dehumidification and temperature control during surface preparation, http://www.sspc.org [l6.28.407]

Safety equipment and procedures: ©

Clean and preserve fuel oil tanks, steering gear and shaft alley areas

WORKSHEET- PURCHASING - SALES

Fig. 1.155

must be capable of writing a detailed work report, and record in depth in place safety procedures which are adhered to by all involved before a hydro-blast operation commences, confirming a flawless work-application solution, followed after the daily job completion by a recorded tailgate safety meeting. 80% of the

Fig. 1.156 Coating removal in progress

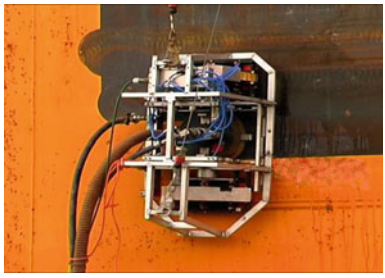


Fig. 1.157 Coating removal

available application load can be handled in this field between 3,000 and 14,000 psi at five to 60 gpm and includes rubber removal on aircraft carrier runways, servicing boiler tubes, heat exchangers, oil lube systems and compressors, hydrostatic testing of boilers, condensers, pipes, pressurized vessels and tanks. Degreasing and preservation applications are considered extensive and require a knowledgeable labor and management force.

Shipyards often require that visiting contractors, subcontractors, including their sales forces, undergo an in-house safety course and awareness training to limit the possibility of accidents and fires in their workplace. The type of alarm systems, how to evacuate in specific or differing emergency situations, location of designated assembly areas, primary exits, location of fire extinguishers, etc., are the primary functions explained to visitors.

Working offshore demands another set of competency in personnel training which is specifically designed for oil–gas platforms and their supply vessels, drill rigs, submerged work methods and emergency response procedures. The logistics of working in confined but highly visible areas on offshore structures (Fig. 1.157), job planning and equipment mobilization procedure are a critical function, as is the communication between owners, coating inspector and paint crew. Offshore hydro-blast or UHP equipment and accessories must be functional under any and/or imaginable circumstance.

Fig. 1.158 Ballast tank coating removal

Equipment down times due to mechanical, technical or labor induced criterion is unacceptable. Naturally, ongoing work procedures can be interrupted by weather. Service providers do well when offering alternative job descriptions. Cleaning tank and ballast tanks (Fig. 1.158), mist eliminators, heat exchangers, condensers, oil lube systems, heaters or performing the coating removal on a helicopter pad, etc., are some of the possibilities that should only be offered while in the job procurement phase. The continuous corrosion protection efforts necessary on offshore oil and gas production facilities, including the floating production, storage and off loading vessels (FPSO) and may consist of servicing stripped-down decommissioned oil tankers rebuilt and re-equipped to perform oil storage, separation or drilling processes, provide a constant business potential for qualified entrepreneurs. There are several types of drill rigs, jack-ups, which are towed to their drill locations where the legs are lowered to the seabed and the operating platform is lifted above sea surface. The drill ships appear somewhat like seagoing vessels, except they feature a drill derrick above their deck line with a hole through the center of the hull, accommodating the drill pipe assembly. Submersibles are drill rigs floated to shallow water locations and ballasted to sit on the seabed. The semi-submersibles have their superstructure attached onto pontoons or a hull and are ballasted below the water surface. Large production platforms vary in size and provide long-term accommodations for the operating crew and varying maintenance personnel. Production equipment and processes differ according to product quality, extraction process of oil or gas and the necessity to make products ready for transport. They can be anchored or tethered to the sea floor and are considered a floating-production, storage and offloading facility (FPSO), or tension leg platforms (TLP) typically built from steel or concrete and are likewise anchored to the sea floor by vertical “tendons”.

Often services are performed while platform is in production. At all times and regardless of environmental circumstance, a contractor must protect the platforms operating environment. This includes protecting the crew from possible physical

Fig. 1.159 UHP gun, coating removal at 43,000 psi

harm by high-pressure water, maintaining the job vicinity free of static spark possibilities, fire hazards, accumulation of dust, abrasives or any other wind-swept refuse which compromises mechanical seals, lip seals, packing glands, etc (Fig. 1.159). This includes protecting rotary equipment such as pumps, compressors, turbines, ventilation equipment, the water desalination environment, etc. The effective implementation under severe weather conditions of rigging, scaffolding, hydraulic man lifts must always be considered within the job description and criteria, which includes the correct transportation and positioning of hydro-blast equipment on a supply boat, barge or platform. Water supply can be taken from the desalination plant or ballast water, guarded by filtration equipment and considering pumps operating requirement. Offshore main process equipment for separation of oil, liquids and gas, including the utility system such as seawater desalination components, heating and cooling system, vent and drain systems are of general nature and serviced by hp-water application techniques adapted from refinery-gas or industrial applications.

A relatively new equipment identity providing the ultra high-pressure abrasive blast capability (UHP-AB) is nowadays a somewhat standard coating and corrosion removal technique found superior in its cost effectiveness and operational procedure (speed), especially on offshore oil rigs and equipment. Minimal dust emissions due to minute abrasive expenditure, delivering an excellent coating adhesion (anchor profile), and comparatively low fuel consumption can provide the competitive edge. A prerequisite when applying corrosion control coatings in the splash and title zone or below is to perform a multi-level inspection including visual, ultrasonic and radiographic methods verifying, for instance, weld seam-fusion or corrosion levels on pipeline or any other structural integrity. The hydro-blast technique performed by industrial divers is therefore essential (Fig. 1.160). Submerged applications performed by underwater abrasive blast techniques since 1962 were first thought of by maintenance crews servicing floating dry-docks, piers, locks and dams in Germany's extensive shipyard facilities. In the late 1960s industrial divers utilized floating hydrostatically balanced abrasive pots operational

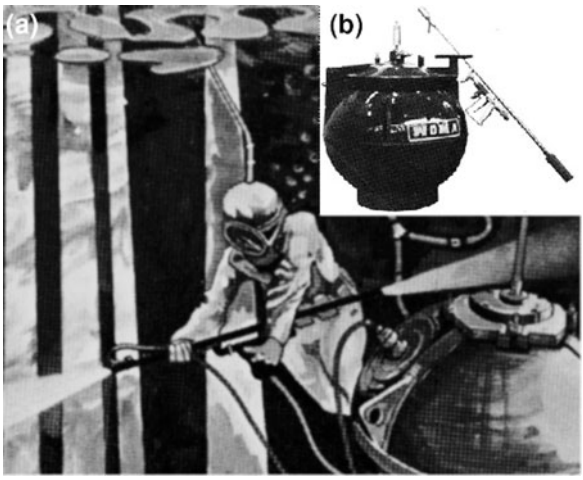


Fig. 1.160 Underwater abrasive container and diver **a**, **b**

at any depth they were accustomed to. Hp-gun-abrasive-injector combinations with recoil of set were then powered with a 75 hp drive. At this time the system outperformed any other available method producing an anchor profile on steel surfaces to customary abrasive blast standard S.A. 2-1/2. It can also be noted that the French navy in the late 1960s through early 1970s, were the first to actively prepare ship hulls by applying experimental coatings specifically designed for installation below the water line with various successes on their vessels. The superior surface modulation effects achieved with abrasive hp-water on concrete surfaces resulted in the immediate support of concrete repair procedures on concrete piers, dikes, spillways and water dam structures in marine harbor, river and lake environments.

Commercial and recreational boating, their marinas, harbor and pier structures, vessel maintenance environments, workshops and storage facilities, etc. are all business identities important to a service provider. Required pressures are 3,000 psi plus, hot and cold water preferably with a pump drive starting at minimum with 18 hp. plus, facilitating the utilization of water, abrasive blast injectors, 2″vacuum equipment with filtration and water recycling equipment, applying pipe and sewer cleaning nozzles, floor Spin-Jets producing 10,000 ft^2 plus per hour, chemical metering and foaming attachments for confined space cleaning and preservation applications.

Most often, in this ecologically vulnerable environment where a pollutant of any type, including generating water turbidity is viewed with suspicion and therefore cannot be introduced to the river or lake water. This includes the indiscriminate cleaning of submerged surfaces bearing aquatic growth, creating turbidity (Fig. 1.161).

It is of importance within most job requirements to recommend water recovery and filtration capabilities when services are provided on vessels, piers or interior jobsites such as machine shops, tanks, storage facilities, loading docks, etc.

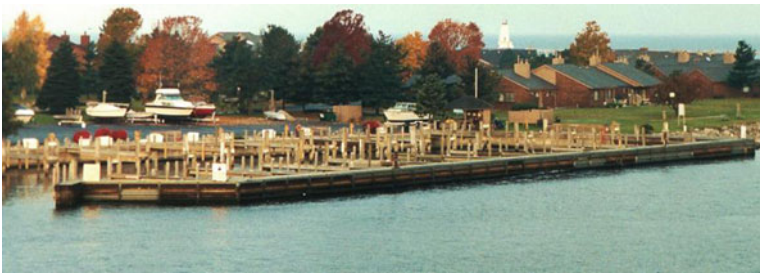


Fig. 1.161 Recreational facilities

Fig. 1.162 Manual algae and coating removal

Barnacles, algae and general marine growth can also be removed below or within the water splash zone of any water bound surface structure or vessel applying the simplest filtration methods (Fig. 1.162).

Contractors working with full-service marinas should always first inquire on their developed regulatory criteria and restrictions which identify the storm water discharge requirement. A spill prevention response plan, maintenance and good housekeeping program, customer established best management practices and the correct implementation regarding materials-chemical storage, machine shop-engine and maintenance-cleaning (Fig. 1.163) area and their methods are a prerequisite for a water discharge permit. This includes oil water separation equipment or their underground facilities, approved abrasive air–water blasting or pressure-washing operations which can include coating-painting procedures in dry docks or above ground facilities (Fig. 1.162). These areas, location, products or work methods also require regulatory approval before a general storm water discharge permit is granted.

Contact. Shippers, integrated barge owner companies transporting raw materials, independent barge brokers, barge owners transporting grain, lumber, iron ore, barge rental and shipyard facilities, tugboat towing services, their maintenance and purchasing departments, barge rebuild companies, marine chemists and coating inspectors, marine salvage companies, Naval, industrial–commercial shipyards

Fig. 1.163 Ship-hull washing

management or commercial and private marinas, their engine and vessel repair facilities.

Resources. Shipper associations, AWO, American Waterways Operators Associations, 801 N. Quincy St, Suite 200, Arlington, A 22203, http://www.americanwaterways.com. Maritime Law Associations. Inland Rivers, Ports and Terminals, IRPT, 204 E. High St. Jefferson City, MO 65101. Transportation equipment cleaning guidelines. Superintended of Documents, US Government Printing Office Washington, DC 20402, Ph. (202) 512-2250. On the Internet "barge cleaning guidelines".

Safety. OSHA standards for shipyard competent person training, which includes atmospheric testing, confined space awareness, confined space attendant, "monitor-hole watch", confined space entry/rescue, confined space entry/attendant supervisor. Identify and define confined spaces, recognize hazards, entry requirements, proper use of equipment, understanding signs or systems, and consequences of exposure, maintaining accurate count of entrance, how to monitor activity inside and outside of space to determine if it is safe, verify that rescue services are available, train to perform none entry rescue, filling out and verifying entry permits, ensure regularly that all tests specified by permit have been conducted. Perform safety meetings-tailgate safety meetings, lockout-takeout procedures, fall protection, competent person or awareness and preferably provide a hazardous communication course (HAS-COM). When working in these environments, always be aware of possible hot work down line from confined spaces, especially on product supply lines (fuel). Coordinate your actions with hot work permit procedures.

"Safety standard for marine vapor control" by US Department of Transportation, United States Coast Guard, http://www.purgit.com/navic1_96.html.

APPLICATION REVIEW

Customer, Company: Web site: e-mail:		Date: Nr: Address: City: State: P.O. Box: ZIP Code:	
Purchasing	Engineering	Maintenance	Safety
Tel: e-mail: Area:	Tel: e-mail: Area:	Tel: e-mail: Area:	Tel: e-mail: Area:
Job Description:			
Job Location:	Job Site Risk Assessment:		Specify:
Job Site Review: Trade Related Publications: 21. SSPC (2000) Standard Method of Evaluating the Degree of Rusting on Painted Steel Surfaces, http://www.sspc.org [6.28.407] 22. SSPC-NACE (2001) Guide and Reference Photographs for Steel Surfaces Prepared by Waterjetting, http://www.sspc.org [6.28.407] 23. SSPC-NACE (2001) Guide and Reference Photographs for Steel Surfaces Prepared by Wet Abrasive Blast Cleaning, The Society for Protective Coatings, SSPC, http://www.sspc.org [6.28.407] 24. SSPC (2002) Guide and Reference Photographs for Steel Surfaces Prepared by Dry Abrasive Blast Cleaning, The Society for Protective Coatings, SSPC, http://www.sspc.org [6.28.407] 25. SSPC (2004) Guide and Reference Photographs for Steel Surfaces Prepared by Power and Hand Tool Cleaning, The Society for Protective Coatings, SSPC, http://www.sspc.org			
Safety equipment and procedures: ©			
Clean and preserve floating docks, fueling and maintenance areas.			

WORKSHEET- PURCHASING - SALES

1.20 Municipalities' Water–Wastewater Treatment, Shopping Zones, Parking Facilities, Exhibition and Sport Arenas, Highway-Road Services

The business potential generated in city or county municipalities should not be avoided by informed and successful service providers. The assortment of work encompasses all applicable tool varieties in performing a surface preparation or cleaning application found throughout the commercial and industrial environment. In his daily endeavors a successful and well-resourced entrepreneur is accustomed to provide, within his job criterion and description Worker's Compensation insurance, covering his employees and complying with all applicable state-federal laws and regulations and offers to his customers comprehensive liability insurance ($500.000–1,500.000 property damage umbrella). He further guarantees equal opportunity employment and customarily provides possible subcontractor certification and necessary insurances or performance bonds. These general requirements are not enough to successfully participate in a governmental business setting. Challenging, the municipal milieu can be very competitive, intense and sometimes confusing. Some cities may give preference to companies owned by women or minorities, which may require performing services in a subcontractor status. Waiting or down times, bidding terms and conditions, excessively high insurance requirements or excessive liquidated damage amounts, resulting in bonding requirements favorable difficult to obtain, can be a hurdle. Variable safety standards and procedures, work scheduling considering ambient conditions for the coating installation, restrictive working hours and weekend limitations are all factors only a well rounded service provider is likely to stomach. Encountered paper work necessities developed by county or city purchasing departments concerning vendor registration processes can also be taxing. Pre-qualifying for purchasing departments' source lists covering the applicable category or possible services provided by an entrepreneur is essential. Providing an educated labor force and the best possible equipment for a job description, combined with established and safe environmentally correct work methods may positively sway purchasing and maintenance-superintendents decisions, but by no means never, ever, should one consider this a given.

The contractor's service repertoire in wastewater treatment facilities is categorized into four major identities, as follows:

A. Cleaning the interior of failed process equipment and digesters by removing compacted organics, snails and sewage utilizing the Hydro-vacuum system shared with mobile vacuum containers, or pumping the effluent directly through the injector assembly over long distances to alternative tanks, settling-evaporation ponds and tanker trucks is a standard practice. As is cleaning, pumping and safely removing caked sedimentations from evaporation-settling ponds (Fig. 1.164) by slurrifying or emulsifying waste into a semi liquid form conveying the mass by the Hydro-vacuum technique. This enables a job completion avoiding usual and likely

Fig. 1.164 Evaporation-settling ponds

Fig. 1.165 Wastewater plant

damages created by mechanical equipment to susceptible pond membranes consisting of clay, asphalt or plastic liners. Pulling plastic or gravel filtration media through the injector assembly is also a quick and unsurpassed cleaning method of the filter media itself, while in process returning the media to its vessel or clarifying location.

B. Applying enhanced hydro-horsepower for pipe or sewer jetting applications achieving industrial performance standards, or offering prior to coating procedures a blast cleaning with the HP water-abrasive or jetting method on steel purifying vessels (charcoal filter), filter presses, lock-gates and sliders, including mechanical scrapers which remove scum, grease and other floating debris from wastewater, mixing tubes in settling basins, effluent weir plates, weir troughs' and in operation submerged aeration pipes which are under constant corrosion attack as are cat walks and ladders belonging to the second application identity.

C. Nationally deteriorating at an alarming rate, the aging wastewater plant infrastructure (Fig. 1.165) offers to pressure-washing, hydro-blasting or UHP service provider, several opportunities inherently ideal and far superior to familiar cleaning, neutralizing, abrasive blasting and concrete rehab-breaking techniques. Trying to stay abreast of or controlling ongoing deterioration in wastewater treatment facilities where hydrogen sulfide gases (H_2S) and sulfuric acid (H_2SO_4) eat away or attack large aggregate and erode exposed interior-exterior concrete surfaces, steel fixtures or essential equipment, chemist and maintenance departments operate within a continuous maintenance procedure. Today, advanced coating systems designed for waterworks and wastewater treatment facilities

Fig. 1.166 Wastewater clarifier

require the best possible surface-substrate preparation, therefore the UHP and hydro-blast abrasive blast technologies are called upon. In older facilities, deteriorated coal-tar coatings are usually present and are replaced with coating systems designed for specific plant locations and process oriented performances, not only to inhibit but also in some cases to stop the deteriorating erosion processes altogether. Coatings are identified for exterior weathering, UV and mild chemical exposure for steel or concrete surfaces, interior environment exposure for steel, concrete walls and ceilings, immersion for wastewater collection (Fig. 1.166), primary treatment and/or secondary b treatment on steel and concrete surfaces in immersion-tertiary treatment facilities and/or secondary concrete containment areas.

The identification and classification of a deteriorating area, and its necessary substrate removal volume must be determined before a correct hazardous waste disposal classification and method can be suggested.

When working in a pretreatment sewage process area or confined spaces in the presence of live flowing sewage water, uninterrupted monitoring for the possible presence of highly toxic hydrogen sulfide gases must be a given. In particular where the removal of grit-sand, gravel and other heavy solids and/or organic particulates that have settled out by gravity from the wastewater stream are removed before the frayed concrete-coating removal application is introduced (Fig. 1.167). Confined space entry procedures, continuous air breathing apparatus, egress gear, and correctly wearing full face respirator gear are fundamental to the job description. Work areas will include the facilities closed influent and effluent channel areas, grit chambers, primary sedimentation basins and the channels between them. In primary clarifiers, also referred to as primary sedimentation basins, where construction joints are highly susceptible to erosion by developing gas above the operating waterline, including the interior roof services and exposed walls, deteriorating concrete is generally always recognizable. This includes the interior digester's roof structure and when in operation the exposed settling basin walls. Damaged coatings on older structures most likely consist of coal tar heritage and are easily removed. Coating failures on cat walks open primary-secondary clarifiers, at times also called primary and sedimentation basins, occur mainly to steel anchor-fittings, and the submerged aeration piping including their scrubbers. Services are probably required when a major unit shutdown is in progress.

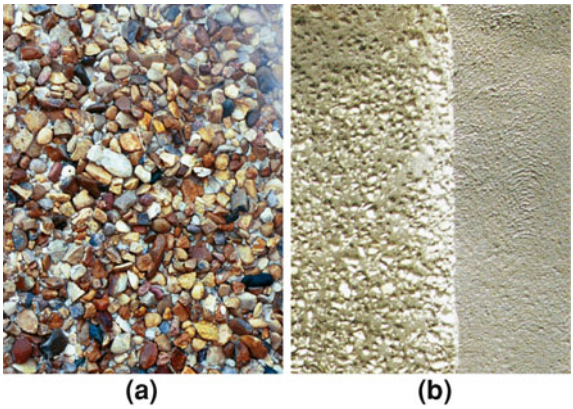


Fig. 1.167 **a** Neutralized aggregate, **b** restored aggregate surface

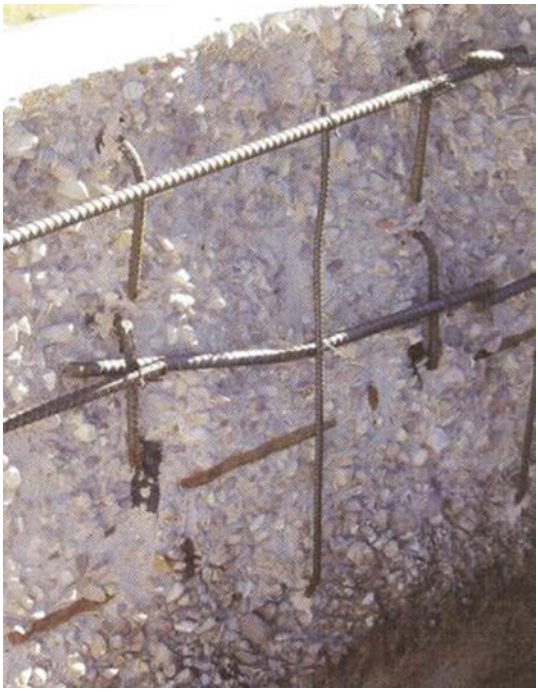


Fig. 1.168 Classic concrete deterioration

Wastewater facilities are humid environments in which surfaces can or will be saturated with moisture, therefore work methods must be quick in concrete removal (Fig. 1.168) and coating drying-curing times, especially in areas where plant operations cannot be shut down for extended periods of time.

Where structural integrity must be reinforced on walls, splitter and chamber boxes or roof structures, etc., the available UHP and abrasive hydro-blast technologies provide, in combination with modern cementitious application and

Fig. 1.169 In situ manhole-sewer repair in progress

coating systems, unsurpassed specific bonding and pull off parameters (Fig. 1.169). This becomes especially obvious when testing concrete for essential surface profile parameters, concrete acidity-pH value, and moisture content prior to commencing trowel or spray on coating procedures.

D. The harsh operating environment and the exterior chemical conditions (Fig. 1.170) buildings are often subject to a demand for a continual cleaning and maintenance process designed to protect existing coatings, concrete and steel structures and are ideal application requirements for pressure washing entrepreneurs. Maintaining machine shops, control and laboratory buildings, change rooms, and the general interior hygienic environment, exterior building aesthetics and publicly visible structures or surfaces such as parking facilities, belong within this fourth application requirement.

The sewer and pipe jetting technology developed in the mid-50s, today again gained prominence by its unsurpassed scaling, cleaning and flushing capacities. The ever-expanding, and in many communities a deteriorating infrastructure of pipe and sewer systems susceptible to catastrophic failure which also burdens a wastewater treatment facility, accelerates the need for complete isolated bypass rehabilitation procedures. The industrial high-pressure water jetting-cleaning and abrasive blast application, combined with a hydro-vacuum debris removal routine is preceding to a high-load composite insert installation requirement. Generally, these locations include sewer manholes and shafts, pipelines, tunnels, lift stations, junction boxes and wet well structures. Cleaning procedures and providing

adequate surface roughness is also necessary prior to resurfacing sewers interior concrete and/or brick walls, followed by a troweled or spray on high-performance coating application. The industrial jetting capability is especially of interest when exterior remote installations of flexible tubular lining systems to a sewer-pipe system are planned and performed.

The service provider intending to increase profit margins with sewer and drain cleaning applications must be aware that the potential customers' sense of urgency requires a response criteria not to be compared to a customers scheduled bubble gum removal application. County, city or communities providing sewer-pipe cleaning or vacuum truck services cannot always be available in an emergency. Pre-qualifying with city purchasing and maintenance services is done by identifying the service provider's technical application capabilities into the cities purchasing source guide, which can result in a standby position for possible emergency work. This only works if the responsible city employees are convinced of service provider's advanced equipment status, technical know-how, labor qualifications and highly developed safety curriculum.

County-city water towers or storage tanks, etc., require periodic exterior or interior coating removal applications. This is always a corrosion-aesthetics, leak or contaminant preventive measure and can turn into a visually pleasing exterior art form. Today's remote-controlled UHP coating strip-mill technology permits a cost effective coating installation. Savings occur not only in reduced scaffolding and tarpaulin expenses. Coating applicators follow UHP mill in a stepped sequence similar to exterior fuel tank or ship hull coating removal and installation techniques. When flash rust inhibitors are not utilized, the coating applicators performance solely depend on full surface dryness, after the scheduled UHP stripping, weather or ambient temperature and time flash rust development exceeds the inspector's guidelines or coating instruction.

Regenerating gravel and sand formations, surrounding a tired shallow or deep water well which includes the cleaning of the well's sump and the submerged suction side of pump stations and the discharge piping is an application that was introduced in the mid 1960s. The technique itself is applied today in the US mainly as a soil stabilizing application (Fig. 1.171) and represents an added entrepreneurial capability. In the mid 1970s Nozon Corp. of Germany successfully serviced throughout the African continent hundreds of plugged-silted gravel-soil formations in the vicinity of solid or corrugated well spears, generally in a radius of 200' and down to 90' plus depth. The process often provided a better than new well performance history. High velocity water is introduced to gravel and important soil formations by hydraulically operated high-pressure water rigid-lance assemblies (Fig. 1.172) with a nozzle configuration, producing a high velocity turbulence forcing silt into the wells negative system where the sewer cleaning and hydro-vacuum method is applied to clear and clean all gravity areas.

Shopping zones and their parking facilities and hopefully abundant car and foot traffic, holiday and special event businesses strive to maintain a functioning, environmental friendly and aesthetically pleasing environment. Providing a

APPLICATION REVIEW

Customer, Company:		Date: Nr: Address: City: State: P.O. Box: ZIP Code:	
Web site: e-mail:			
Purchasing	Engineering	Maintenance	Safety
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Job Description:			
Job Location:	Job Site Risk Assessment:	Specify:	
Job Site Review:			

a b c

d e

Typical deterioration of an concrete and coating matrix:

Safety equipment and procedures: ©

Evaporation pond, purifying vessels, coating removal on lock gates, tank cleaning, primary and secondary digester cleaning, Sewer-pipe cleaning.

WORKSHEET- PURCHASING - SALES

Fig. 1.170 a–e Typical deterioration of an concrete and coating matrix

diversified service capability achieved by quickly convertible equipment to a multitude of application varieties encountered can often be of an essential business survival strategy.

Fig. 1.171 Soil stabilizing application

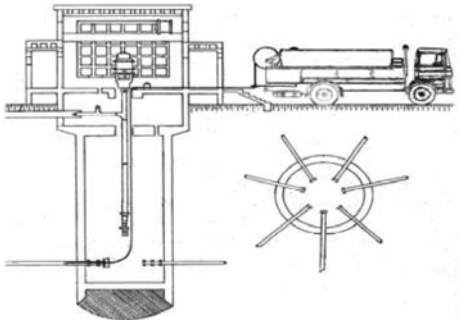

Fig. 1.172 Corrugated well spears-pump station

Introducing a blast-water filtration and recycling capability for coating removal or surface cleaning applications on plaza areas or parking deck facilities, including removing oil residue from parking lot surfaces, proves to be a successful sales strategy, especially when combined with a concrete seal installation or general deck maintenance in preparing and sealing concrete damage resulting from stress or freeze cycling. This also includes the repairing of expansion joint systems, as is the bubble gum and graffiti removal technique servicing restaurants and shops in their vulnerable areas. The sales potential can naturally be expanded to exhibition and sport arenas, schools, public golf courses, tennis court resurfacing applications and so forth.

Fig. 1.173 Rigid-lance assembly at saturation depth

Large stadiums or arenas are especially of interest due to their physical size. Horsepower requirements are low (18 hp-plus), producing high-pressure hot-water at 3,000 psi plus. Chemical and disinfectants application knowledge is important as are managerial skills combined with systematic high energy hp-hose positioning tactics supporting but not impeding the gun operator in his jetting endeavors, producing a speedy job completion.

Food concessions and their areas wash and restrooms or sometimes competitors' facilities where environmentally correct cleaning procedures are a marketing consideration, ground keeper's maintenance, service and shipping-receiving areas are potentials identified by aggressive sales tactics.

A Restoration project on historical buildings is another facet pressure washing and hydro-blast services must consider. Specializing in stone masonry and concrete restoration, which include soil and stain removal applications on fountains and city art deco pieces or historical statues, is lucrative.

Highway road services, cleaning toll plazas, their booths and road surfaces from oil, grease and carbon contaminants and providing services to highway rest areas facilities are also essential. Salesmen in consultation with highway departments must not forget to offer the removal of provisional road markings on construction sites avoiding depressions in road surfaces common to grinding or abrasive blast techniques Fig. 1.173.

Contacts. Maintenance and Purchasing for municipal solid waste management, consultants for organic waste management. Municipal engineering for source development concerning utilities infrastructure, wastewater system upgrades in

Fig. 1.174 **a** Recreational area and competitors shops, **b**, **c** concession-public washroom facilities

pumping stations, digesters, etc., including their storm water collection, retention and conveyance systems. Contact purchasing, maintenance and consultants for building infrastructure concerning administration for municipal buildings, recreational facilities (Fig. 1.174a, b, c), City municipal swimming pools, library buildings, maintenance garages and storage facilities including engineering departments for curb, gutter and sidewalks, as well as supervisors for the sewer storm water management program.

Resources. Municipal Management Associations, Municipal Management Consulting Association, National Association of Purchasing Management, The National Contract Management Association, National Institute of Governmental Purchasing, Inc., Federal Regulations, State Regulatory Authority, County Regulatory Authority, Municipal Land-Use Regulation and Control, storm water permitting, information, Water and irrigation conservation ordinance.

Safety. The labor force providing services in wastewater treatment facilities must be trained to identify plant area and its specific potential hazards. Tightly adhere to preventive measures for a multitude of possible volatile and somewhat unpredictable conditions occurring in these facilities. There are responsible safety officers and competent plant operators controlling the written plan for a permit required in the confined space entry procedure, explaining materials, equipment and methods used during the cleaning process, evaluating and possibly verifying functionality of personal protective equipment, guarding from exposure to raw sewage, gases, oxygen deficient voids, fire and explosions due to formation of flammable gases, dust and so forth. A continuous recording and identifying of atmospheric conditions for toxic gases such as hydrogen sulfide and carbon monoxide, oxygen levels-deficiencies and oxygen rich atmospheres, including testing for flammable atmosphere caused by methane and other gases or vapors is

necessary. At all times, ventilation equipment must be capable of replacing airborne hazards with verifiable atmosphere in a continuous function, controlling the atmosphere for a safe confined space entry and fluid job procedure. Take-out, lock-out procedures for electrical and mechanical devices, including flow bypass or diversion equipment is also a required capability, independent but in unison with plant operators and their procedure. Never follow a fallen comrade into a confined space for rescue. Activate the in place rescue procedures by immediately notifying designated trained rescue personnel and ensure all required equipment is present before a rescue into the confined space is activated. More people die in failed rescue attempts than those who needed rescuing. Always check for water flow bypass or diversion mechanisms in case of rain or flash flood conditions. Establish emergency communications procedures and know how to immediately contact medical response and plant rescue services. By no means are these the only guidelines and regulations necessary to perform within wastewater treatment facilities. Besides the wastewater treatment plant's operational handbook, OSHA's second edition manual for safe work practices in wastewater treatment facilities is a great information source for regulations, codes, safety standards in areas concerning pressure washing and hydro-blast (UHP) application requirements. "Safe Work Practices for Wastewater Treatment Plants" http://www.OSHA29 CFR1910.146. Sewer, pipe and manhole cleaning or rehabilitation can be a potentially hazardous undertaking. Safety regulations, requirements and labor force training differ from wastewater treatment facilities. There is no one individual culprit, but more or less a combination of dangerous possibilities often underestimated by either too confident or complacent attitudes. Preferably, sewers and pipes are cleaned by utilizing the natural gravity flow of a system. This automatically introduces traffic either vehicular and/or pedestrian to the work site of the service provider's labor force and equipment.

Protection of pedestrians, vehicles, and labor force alike, which includes every part of equipment operation, is performed by utilizing signage, safety cones, barricades and possibly a traffic control supervisory team. Regulations can vary by state for signs, signals and barricades. The OSHA traffic control safety workbook for the construction industry is also of great help, as is the American National Standard (ANS) for traffic control supervisors. A storm water and sanitary sewer entrance demands a confined space entry permit as the labor force is likely to be exposed to hazardous atmospheres. Never, ever retrieve an accidentally dropped tool, nozzle, flashlight, etc., from the bottom of a manhole which constitutes a confined space entry (Fig. 1.175a, b). Personal protective clothing and equipment, adequate personal hygiene practices, no eating, drinking or smoking within the work area and open sewer-pipe are a commonsense "must adhere by" behavior ritual to limit or avoid exposure to biohazards. OSHA hazardous exposure and risk assessment, standard regulations for bacteria, pollutants, toxins, chemicals, and blood borne pathogens common to the content of sanitary sewer refuse must be closely followed. Also, in specific applications, precise, detailed written safety requirements and procedures are always practiced and enforced by supervisory staff. Contractors that find themselves inserting nozzle assemblies (Fig. 1.176)

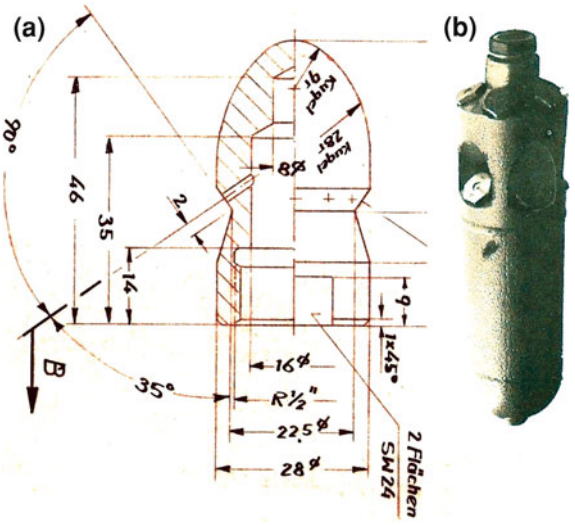

Fig. 1.175 **a** 1958 Sewer-nozzle design, **b** 1960 Sewer-multi nozzle carrier design

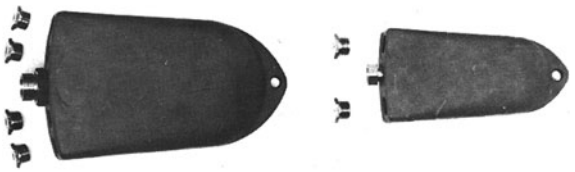

Fig. 1.176 1961 Interior bottom profile, sewer flushing heads

within an excavated trench area more than 4' deep must make sure that there is a qualified competent person present as explained in OSHA regulation 29 CFR 1926, responsible for the excavated or trenched job site. Besides the remaining dangers of a correctly secured trench location, water or high-pressure water velocity can quickly be a critical destabilizing factor when inadequate cleaning operations are performed. Destabilizing by heavy load, vibrations, pressurizing or removal through water velocity and water saturation of soil formations can immediately endanger labor forces surrounded by weakening structural integrities. This can result from an incorrect nozzle choice with an over and above necessary power input, undetected faulty or damaged sewer-pipe structures where high pressure water jets found cavities or cracks, etc., on interior pipe surfaces. Tunneling effects can occur quickly and are possibly recognized by operators detecting visually changing debris flow and/or substances. This, by the way, is another reason to always work with the natural designed downhill flow of a sewer system to possibly permit a quicker visual recognition (refuse color change) of such a problem by eliminating the pooling effect while flushing (Fig. 1.177), this especially when prior problem detection by camera is not available.

APPLICATION REVIEW

Customer, Company: Web site: e-mail:		Date: Nr: Address: City: State: P.O. Box: ZIP Code:	
Purchasing	Engineering	Maintenance	Safety
Tel: e-mail: Area:	Tel: e-mail: Area:	Tel: e-mail: Area:	Tel: e-mail: Area:
Job Description:			
Job Location:	Job Site Risk Assessment:		Specify:
Job Site Review:			
Safety equipment and procedures: ©			
Man-hole rehabilitation-sewer cleaning, water well cleaning, toll plaza cleaning, and parking deck coating removal.			

WORKSHEET- PURCHASING - SALES

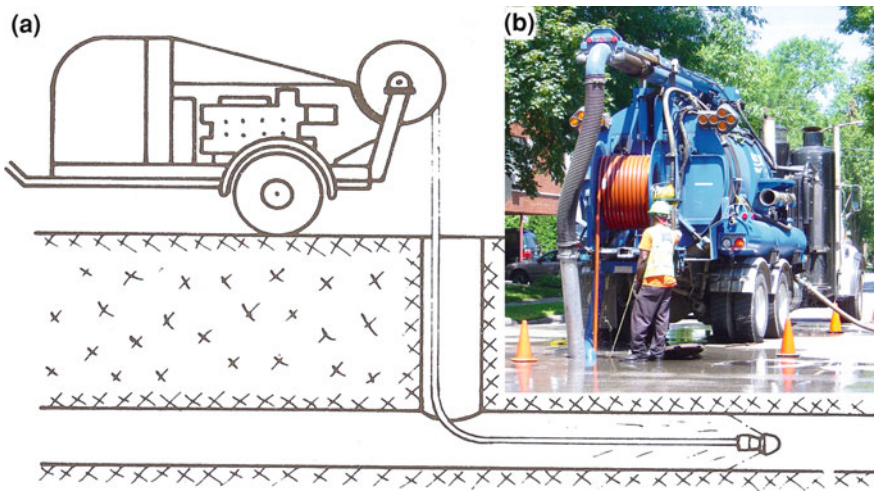

Fig. 1.177 **a** 1958 Sewer-pipe cleaning technology by Wolfgang Maasberg Sr., **b** Modern combination vacuum-sewer cleaning equipment

1.21 Pharmaceutical, Cosmetic, Drug and Dietary Supplement Industry

By providing customized cleaning solutions to the pharmaceutical, cosmetic, drug and dietary supplement industries, contractors and hydro-blast equipment manufacturers learned at once that application requests strongly and independently differ with products manufactured. Computerized and automated production is often lot-based. Large quantities of raw materials pass from one process step to the next, leading to final products such as creams, ointments, tablets, capsules, aerosols and inject table solutions. The medical drug and supply criteria for veterinarians can be included within this application variety as does the cleaning of manufacturing hardware, equipment and facilities for surgical gloves, sutures and dressing production lines.

Application techniques are best identified when considering a likely natural biological separation–extraction process or chemical synthesis. Operational functions are the separation of medicinal chemicals including but not limited to, antibiotics and vitamins from microorganisms, botanical and biological products thru extraction and purification of organic chemicals from vegetative materials or animal tissues and the not so natural chemical synthesizing or synthetic processes. When synthesizing pharmaceutical products, volatile organic compounds and pollutants (VOC) are contained. Seasonal batch requirements, product changeover, accidental or as a result of equipment failure, therefore possibly emitting contamination to the environment which results in the procurement of pressure washing or hydro-blast services in particular when this is combined with an area or equipment decontamination procedures.

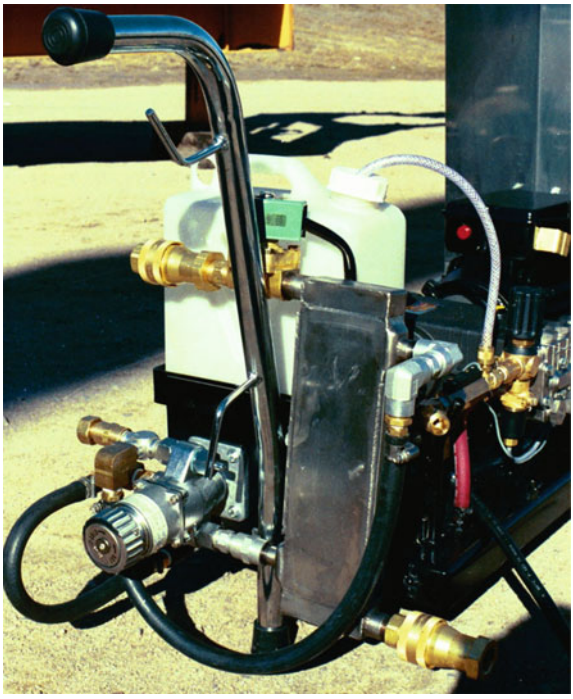

Fig. 1.178 Pressure-washers heating element

The following equipment identities and production areas are cleaned and decontaminated by service providers: Autoclave or batch reactors which are often glass lined hosting the chemical reaction and double as holding tanks, mixers, heaters, crystallizers and evaporators or cleaning distillation equipment and their heat producers. Consider as typical the condenser and secondary condenser cleaning application, which includes tray, rotary and fluid bed dryers, wet-dry scrubbers and carbon adsorption equipment. Service providers streamline their safety equipment to avoid any possible contact with pollutants applied in the pharmaceutical separation technology. Solvents of a wide variety are utilized within processes (acetone, amyl alcohol, benzene, ethanol, ethyl acetate, toluene, etc.) therefore specific care must be exhibited, warranting safe working conditions.

While in a production sequence, custom-designed clean-in-place equipment systems (CIP) are found throughout most operations, supporting a bio-cleaning process. Manually cleaning and sanitizing with hot high-pressure water can today be a customary maintenance function. Plant generated steam is utilized to continuously heat the pressurized water between 185 and 225°F (1,500–5,000 psi at 5 gpm, avoiding within a hygienic environment the utilization of burner assemblies (coils). Temperature adjustments and levels are precise (Fig. 1.178) and do not fluctuate or spike due to operators on–off jetting procedure (cycling). This characteristic can be of importance where continues high heat sanitizing procedures are a must.

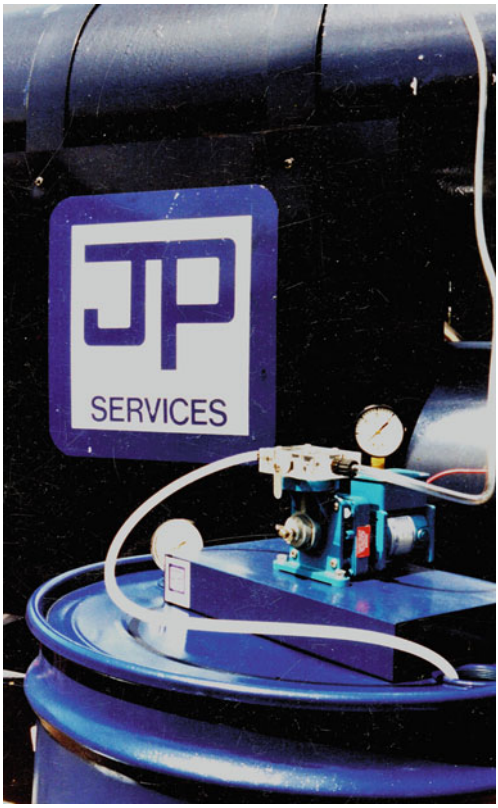

Fig. 1.179 Chemical metering utility

Service providers must be capable of verifying plant or in-house laboratory identifications of existing waste characteristics, pollution prevention and control methods.

Cleaning of manufacturing areas, their exterior equipment, interior walls, ceilings and floors which are usually constructed to withstand repeated aggressive wash downs, or cleaning analytical test lab surfaces, their work bench including containment hoods and isolators can be considered one application faced. These areas are most likely not inclusive of a general industrial services procurement procedure. Laboratory environments demand a specialized application curriculum and will most likely be product specific in specialized safety and technical requirements.

Interior surfaces in process areas, similar to the food industry, can feature 100% solid epoxy, epoxy acrylics, polyurea hybrid and advanced resin coatings, etc. and/or oil–grease–acid resistant brick and tile structures. This application will require extensive wash-down training and an advanced skill level in detergent and chemical application techniques, ensuring an imperative surface cleanliness. Offering or providing with cleaning processes a chemical metering utility incorporating a verifiable fluid volume control function (Fig. 1.179) is imperative.

Most always, in-house laboratories will identify or provide critical detergents. They can be low foaming, heavy-duty alkaline detergents as utilized for cleaning lab-ware in parts washers, or low foaming liquid acid cleaners and/or low foaming phosphate free detergents, etc. Often a plant turnaround decontamination, or unit pre-post operational decontamination process which possibly requires removing concentrations of volatile organic, toxic bulk or trace ingredients while executing a predetermined cleaning plan, will include the correct application of such chemicals.

Equipment to be serviced include vapor recovery systems, gas wet or dry scrubbing equipment, bag-house units for particular matter and in some cases high efficiency particulate air filter system's suction (HVAC) and discharge side, including all duct work providing the HEPA filtration for manufacturing floors. Fluid bed equipment performing drying, crystallizing or agglomeration and granulation including dust collectors in tablet manufacturing processes, or dehumidification equipment, freeze-dryer hardware, feeders, extractors and filling or packaging equipment, maintenance shops and cleaning transportation equipment are all identities specifically categorized by customer's maintenance and procurement department.

Preventing cross contamination between equipment and locations during an ambiguous cleaning or decontamination procedure which includes the periodic analytical verification of a successful job completion will be tightly controlled by laboratory-maintenance personnel.

Exploiting the customer's or manufacturer's available liquids as a blast-cleaning, slurrifying, agitating or vacuum-pump drive medium is of significance, in particular when the incentive to return scaled or recovered product back into the production process exists. Also, by utilizing some of the manufacturer's liquids as blast medium one can avoid the contamination of a production process and the isolation of machinery or its shutdown. This is only possible when liquids' specific weight, compressibility, viscosity, foaming or lack of, and abrasiveness of liquids are identified to make adequate technical adjustments preventing pump damage or any other mechanical problem. This generally requires equipment rpm reductions and plunger changes, providing the application oriented necessary fluid volume and pressure configuration. Equipment with automated RPM governors most likely must be changed to manual rpm regulation and then supported by an adjustable pressure regulation and pressure relief function.

With the exception of operations where expensive or dangerous products can be returned to the production cycle, dump guns are not employed. The pharmaceutical or medical product manufacturer will also need to know hp-pumps fluid-end product compatibility which is most likely a given, since fluid-ends generally are manufactured of high grade stainless steel and contain compatible o-ring or packing materials (Teflon, neoprene, delrine, etc.). Equipment requiring grease fittings therefore grease or any other packing lubrication method cannot be introduced. Pump conversions are best performed utilizing manufacturer's expertise (pump-fluid-engineering).

The introduction to operate and clean with purified or distilled high-pressure water and/or light oils found in the pharmaceutical, biotech, and cosmetic process industry may illustrate a comparison to application procedures and methods to the hygienic and bio-safety requirements established throughout agricultural, food, distillation and the general extraction process industries. This includes best cleaning practices and implementation requirements compulsory to the coffee, tea and dairy foods concentrate and powder-granular products manufacturing identities and their plant hardware. Cross contamination is not acceptable under any circumstance.

Cleaning procedures are completely isolated between hardware and exterior surface identities, as must cleaning operations between buildings, clean rooms and laboratories. Pipe systems are capped and isolated, which include valve assemblies. Cleaning and removal of calcifications on reverse osmosis equipment and their storage tanks or cleaning wastewater treatment facilities hardware and general surfaces or pharmaceutical containment systems and areas also belong to this application identity.

As it is within the food industry, sizing operations, grading incoming raw materials, milling, blending and mixing, compression and performing coating techniques with a variety of equipment is part of the manufacturing step. This is followed by bulk packing and product transportation via railroad, truck or barge, which also offers a variety of service opportunities to the pressure washing specialist, operating at 3–5,000 psi range applying both hot and cold water. The service provider working in the food industry can simply adapt his technique to pharmaceutical quality standards. The food industry's hp-water equipment is also simply modifiable. Chemical-acid and heat resistant food grade hp-hose assemblies and so forth are again necessary as is all support equipment. Safety-hygienic gear must prove compatible to refuse encountered within a cleaning environment or process. Cleaning product contact surfaces and multiple use production equipment requires the verification of the cleaning process by customers' analytical method. To avoid problems a contractor best establishes the specific analytical determination for possible residual substance or the lack of. The detection threshold is measured in parts per million or parts per billion. Residual limits after a cleaning process for equipment and diverse surface identities should be guided by practicality, achievability and validated by a test method first established in the contractual procurement phase. This includes maintaining the required timeframe test and verification procedures after a job completion. Also, pharmaceutical outsourcing has grown into a sizable industry. Bulk product manufacturing and packaging requires the same conscientious specialized training for equipment operators and jetting personnel alike and can involve the issuance of PPE fitted closing, which naturally means education in selecting proper equipment, providing records of training routine and regular inspection of the equipment itself and its' maintenance. Area contamination and emissions consisting of potentially accumulative volatile organic compounds can be found in unsuspecting areas or within equipment identities, especially when services are provided to pharmaceutical contract manufacturers with, now and then, not so stringent safety guidelines or

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Customer, Company: Web site: e-mail:		Date: Nr: Address: City: State: P.O. Box: ZIP Code:	
Purchasing	Engineering	Maintenance	Safety
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Job Description:			
Job Location:	Job Site Risk Assessment:		Specify:
Job Site Review:			
Safety equipment and procedures: ©			
Slurrifying, agitating and pumping sedimentations or products, wastewater treatment facility, tank cleaning			

WORKSHEET- PURCHASING - SALES

enforced controls. Small-scale pharmaceutical manufacturing facilities, their water systems, waste water treatment facilities, particulate bag house units and critical utilities "clean rooms" are ideal entrepreneurial business entry-level identities. The US Food and Drug Administration (FDA) has categorized this field into various and obvious topics: Food, including dietary supplements, drugs, medical devices, vaccines, blood products and other biologics, cosmetics and veterinary medicines.

Contacts. Pharmaceutical and biotech laboratories and manufacturing facilities. Chemical, mechanical and process engineers, analyzing product quality and equipment status in sizing, milling, blending, compression and coating operations in the dietary supplement industry. Contact bulk manufacturers (agriculture, mineral mining and chemical industry), operations of pharmaceutical chemicals (BPCs), their purchasing, maintenance and shipping departments, etc.

Resources. Pharmaceutical Research and Manufacturers of America (PhRMA), Pharmaceutical Drug Manufacturers Association (PDM). Independent Cosmetic Manufacturers and Distributors, http://www.icmad.org. Best practices from Bayer's, Johnson & Johnson, Glaxo in implementation of various compliances in FDA 21CFR. Industry good manufacturing practices, in production and process control, packaging and labeling, CFR Code of Federal Regulations, industries manufacturing practices for human and veterinary pharmaceutical products 21CFR 210-211, biological product-21 CFR 600 and 21 CFR 620.

Safety. All industrial and commercial safety procedures and equipment classifications, including choice of respiratory protection may vary between installations and areas or products manufactured. Specialized personal protection can be required guarding against toxic and volatile conditions. Confined space entry, lock out-take out procedures and a substantial job related combination of controls can be mandatory.

1.22 Pulp-Paper, Paperboard, Cellulose and Engineered Wood-Lumber Industries

Visualizing and developing a variety of cleaning solutions by means of a water-jets genetic impact and velocity to soiled and/or contaminated surfaces in the dairy food industry, Wolfgang Maasberg Sr. focused and applied much of his acquired power-washing technology to the pulp–paper–cellulose production processes. In 1956, Senior and his father Oscar Maasberg delivered maintenance solutions with pump equipment operating at 800–1,200 psi within the pulp-paper fabrication, in particular pertaining to the wet side of pulping processes and their equipment. However, application criterion did not parallel or correspond to cleaning requirements, horsepower-input, tooling, and jetting performances previously found satisfactory when servicing fouled or contaminated dairy-food manufacturing hardware.

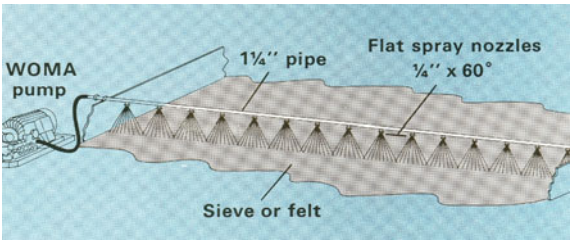

Fig. 1.180 In-place nozzle spray-bar

Fig. 1.181 Traversing nozzle equipment

Essential water volume–pressure configurations to overcome the scales' tensile strength, adherence or bulk accumulations varied substantially but nevertheless were not the only factors concerning an adequate equipment performance.

The continuous distribution and pulp dewatering–drying process required the design and manufacturing of fixed in place (Fig. 1.180, or traversing equipment (Fig. 1.181) operating electric or pneumatic fan nozzle assemblies.

The periodic and automated cleaning of rotating disk filters, suction rolls, bottom-top felts and screen assemblies dramatically enhanced plant operations. Furthermore, outfitting and/or converting cross-longitudinal paperboard cutting equipment with hp-water cutting nozzles abolishing typical knife assemblies presented the first product cutting application instantly formative to industries specific tool design criteria.

Various nozzle and tool configurations, especially in the chemical Kraft or secondary sulfite pulping process required a variety of pump and tool development efforts which resulted in an equipment umbrella recognized as "ATÜMAT". Companies exploiting the recovered black liquor by-product to support paper mills steam generation (recovery boiler) were immediate beneficiaries of this equipment capability. Mechanical pulping processes utilizing refiner disk plates, etc. shared with the chemical pulping method where wood chips are pretreated with sodium carbonate, sodium hydroxide or sodium sulfide and cooked in high-pressure single or multiple continuous digesters dissolving the lining by separating it from woodchip fiber strands, also required specific tool designs. This facilitated particular cleaning services, as it did for cleaning of equipment hardware applying chlorine, chlorine dioxide, hydrogen peroxide, oxygen and/or ozone to bleach the pulp fibers. Chlorination towers, screens and screen-suction roles (Fig. 1.182) which dewater pulp stock during the bleaching process (Fig. 1.183), inorganic and organic scale removal in evaporator tubes or vacuum receiver and all fresh and whitewater tanks, including pulp product feed or discharge pipelines are all subject to periodic cleaning procedures.

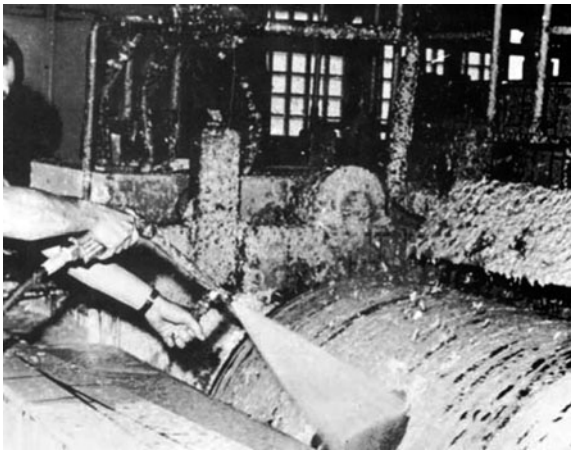

Fig. 1.182 1958 Intermittent suction-roll cleaning

General cleaning operations in recovery boilers are performed on all interior surfaces including smelt spouts, smelt tank interior, super-heaters, boilers generating bank and economizer, steam drum, flu-stack, flu-gas wet or dry scrubbers and bag-house equipment. Make ready by cleaning interior and exterior boiler tubes for necessary periodic hydrostatic test and leak detection procedures including hazardous corrosion analysis. These testing intervals vary between 12 and 48 months.

Depending on shutdowns or maintenance schedule, flash tanks, blow tanks, chip steamers, sulfur recovery system's condensers (Fig. 1.184), lime kilns and calcination equipment must also occasionally be cleaned. Contractors adjusting gpm–psi performances by simply changing plunger configurations did then and now accommodate cleaning services on plant hardware which process recycled pulp from wastepaper and paperboard, creating products like newsprint and sanitary paper.

This advantage in equipment flexibility was particularly noticed when cleaning Material Recovery Systems (MRF) which continuously process newsprint and wastepaper into a manufacturing route creating insulation products, artificial fibers of all sorts for industrial products, including filter cloth and an array of industrial fabrics, ropes, abrasive materials and protective clothing. Hydro-blast personnel must be careful to correctly identify adequate application technology when servicing MRF recovery systems due to a possible mix of nylon, acrylic and polyester fiber operations. Applied process heat to chemically derived fibers drastically alters scale-refuse adhesion, tensile strength and removal characteristics. Similarities in cleaning procedures of manufacturing hardware can be of a visual nature only.

The corrosive paper-pulp mill environment combined with high ambient temperatures and, on a good day, 85% plus relative humidity offer a consistent mixture of coating removal and surface preparation necessities for impending coating installations or concrete repair procedures. These application requirements can be found on the mill's manufacturing floor, hardware-equipment and structural concrete or steel components which reach up to the crane rail installations and

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Purchasing	Engineering	Maintenance	Safety
Tel: e-mail: Area:	Tel: e-mail: Area:	Tel: e-mail: Area:	Tel: e-mail: Area:
Job Description:			
Job Location:	Job Site Risk Assessment:		Specify:

Job Site Review:

a b

a 1963 Advanced and quick exchange fan nozzle design, primarily applied for traversing and/or in-place fixed spray-bar equipment
b Nozzle fixture and body incorporate Bernoulli's inside tapering structure

Safety equipment and procedures: ©

Suction rolls, disc filters, chlorination towers, evaporator tubes, water treatment facilities, settling ponds, evaporation beds, boilers, condensers.

WORKSHEET- PURCHASING - SALES

Fig. 1.183 **a** 1963 Advanced and quick exchange fan nozzle design, primarily applied for traversing and/or in-place fixed spray-bar equipment. **b** Nozzle fixture and body incorporate Bernoulli's inside tapering structure

Fig. 1.184 1967 Tube bundle cleaning

mezzanine beam component surfaces, stainless steel or concrete tanks utilized for storing bleaches, liquors and other corrosive liquids, etc.

Under constant caustic exposure, cleaning and resurfacing deteriorated structural components within the proximity of a paper machine requires a superbly executed hydro-application and an experienced labor force capable of expert tarpaulin installation procedures. Correctly and without fail protecting the operational integrity of the paper machine is imperative. Providing all necessary access for machine operators and tenders servicing their equipment at will and securing a working relationship providing a high degree of flexibility within the job procedure concerning the machine tenders and contractor's crew alike is of fundamental importance. Also blocking and drawing steam from the paper machine is essential in numerous ways. This will somewhat control humidity and without fail (erected coverings) protect surfaces of paper equipment from falling debris, chemical or water contaminants. Jobsite's secondary blast enclosure is mobile, safe and sound, guaranteeing flexibility, avoiding physical restraints to the water-blasting crew and facilitates a secure refuse collection including a possible water filtration-recycling capability. Reinforced polyethylene curtains, plastic sheeting and lumber material is utilized to construct primary enclosures protecting the paper machine, which include secondary enclosures for drive equipment of the paper machine, and most likely will feature it's own access and separate air filtration system. Ventilation, air-conditioning and dehumidification equipment is employed for most coating applications. This again requires a close working relationship with installers applying elastic urethane coating-liners, epoxy coatings and fiber reinforced lining systems withstanding the aggressive chemical and/or thermal environment. The necessary coating classification and installation recommendation will speak volumes in supporting the appropriate hydro-tool selection and gpm–psi performance. The coating product warranty criterion almost always categorizes and identifies necessary surface conditions within the application subject matter. Verifying adequate roughness, anchor profile, aggregates possible pH and moisture content, essential ambient environmental conditions and curing times is a prerequisite. Coating descriptions for interior dry or wet exposure on concrete walls, ceilings and floors are of a standard nature. They are drastically dissimilar for chemical exposure and in acid-caustic rich interiors or in severe wet-end exposure situations

on the paper machines concrete floor and steel surfaces and/or wet-submerged concrete-steel substrates. The corrosion control requirement in operating refineries-chemical plants (product transfer equipment, pipes, etc.) where high temperature insulation must be removed before corroding surfaces are cleaned with UHP water, entertain certain application similarities as today's available high-temperature coatings provide a new application criterion.

In today's strictly controlled wastewater discharge requirement, plant chemists and maintenance managers control a delicate chemical and microbial balancing act. Maintenance prevention necessitates the constant monitoring of effluent characteristics customary to the pulp-paper processes, especially within the high-heat and caustic manufacturing atmosphere.

By nature concrete and metal corrosion is a predominant occurrence and/or on the colder side of a pulp mill line where microbial activity might cause slime deposits compromising the paper quality and possible damages to alloys. The wastewater effluent carrying a major source of pollutants containing organic trace filtrate, will leave the process water in a high biological oxygen demand situation (BOD).

Combine this with dissolved organic carbons (DOC) and a chemical oxygen demand (COD) along with heavy metals, chlorides, alcohols and chelating agents results in a rewarding application variety for qualified service providers within wastewater treatment facilities.

This area offers the exploitation of all pressure washing and hydro-blast application techniques, operating stationary and/or mobile equipment identities, utilizing all facets of modern tool technologies while cleaning precipitators, digesters, diversion basins, primary–secondary–tertiary clarifiers, dredging operations in aeration lagoons or settling-evaporation ponds, etc.

Dust control and removal on the dry site of a modern paper mill is a possible cleaning requirement and a never ending concern to management maintaining their desired product quality. The cleaning regimen is most likely performed within the duration of a cold plant shutdown. Often forgotten or not addressed by contractors marketing endeavors, but nevertheless it is a very lucrative business identity when applying the hydro-vacuum system with industrial vacuum hose-brush and wand-extensions. Within the removal process, dousing airborne debris and dust particles in injector's vacuum chamber renders removed particles harmless and can be directly transferred to plant's sewer system or contractors' water recycling-filtration unit.

Overhead beam structures, air ventilation duct systems and hard to reach structural beam surfaces are cleaned free of flaky deposits, fibers, pulp, dust or other wind-swept contaminants, avoiding the employment of bulky vacuum-track modules and their equipment. Modern paper machines run at 60–80 mph, producing 5–7,000 fpm paper products and can be over 30'wide, situated in a facility as long as a football field. The sheer plant size and elevation of a job location can logistically be challenging. High-pressure water and vacuum-hose runs will vary drastically between jobsites especially compared to older facilities and include long extended sewer-pipe cleaning applications where pressure washing performances (10–25 hp) are most likely inadequate.

In strategic plant locations where pulp buildup or residue impedes a continuous production process, paper mills operate, since the early 1950s, water jetting tools similar to modern day pressure washing equipment. Today, most companies operate electric motor driven 2,000–4,000 psi pump equipment at 4–24 gpm, cleaning periodically failure prone equipment like rotating suction rolls, filter screens or drying pulp from sensitive areas.

This does not necessarily alleviate the presence of customarily centralized pump stations with air equalized and water pressurized tanks feeding super long high-pressure pipe and hp-hose systems. Automated rotating tank cleaning and agitation equipment for storage containers maintaining certain liquidity for pulp and chemical products besides the now and then cleaning application are often also powered by these centralized pump stations.

Fine and technical paper, specialty paper and packaging products are straightforward product classifications within the pulp-paper industry. This has changed within the last 15 years. Nowadays forestry and agricultural byproducts, combined with waste products from the reclaim-recycling industry, produce commodities such as specialty plywood, laminated veneer lumber, laminated furniture components, polymer-wood and thermoplastic bio-composites, etc., and has dramatically extended the customer base for service providers therefore again preventing the stagnation of high-pressure water application development criteria.

Synthesizing-combining these waste products with polymers, polypropylene, high or low density polyethylene, polystyrene, thermoplastic polyolefin and nylon products, etc., enhance possible application varieties. Maintaining or cleaning manufacturing hardware with high-pressure water as a tool may seem quite comparable to cleaning technologies applied in the chemical plant environment.

Except, when there are various applications and work environments which reach into secondary industries such as servicing steam-electric power and fuel producers consuming agricultural products and waste product (biomass).

These business identities, starting with waste-product suppliers, waste-product converters, final product manufacturers and their storage and transportation environments are all great customers for pressure washing specialists. This provides a gradual transformation potential into the industrial services environment for pulp-paper and cardboard manufacturing hardware and can also be jump started by offering cleaning services to area sawmill operations (Fig. 1.185).

Entrepreneurial desires to compete within this industrial market must convey advanced pressure washing, hydro-blast and/or UHP application knowledge and available equipment identities well suited for this field. Equipment operators must be informed and knowledgeable in paper mills operating environment, safety regulations, product flow, locations including aerial recognition of heavy equipment and electrical circuitry within their job criterion.

This includes providing MSDS identification for all chemicals introduced to the company, adequate wash water identification and confined space entry qualifications, confidence in job related lock out-take out procedures and a corporate verifiable safety training requirement.

Fig. 1.185 Sawmill operation

An excellent safety record and experience modifier rating which applies the OSHA recordable rate within the industry and a variety of delighted customers in similar industries will certainly help to compete as well as does the potential of a substantial equipment yard. With minimal equipment modifications contractors performing within power plants, refineries and chemical plant environments are well-suited for this application field.

Contacts. Pulp-paper-cellulose plant engineering and operations management, process engineers, purchasing, contract-subcontract administrators, plant chemists and waste water treatment management. Local-national timber and logging companies, their management in equipment-yards. Engineered wood and Biocomposite-biopolymer product manufacturers' their engineering, purchasing and maintenance departments. For a subcontractor status, industrial painting and coating companies specializing in resurfacing plant equipment, structural concrete surfaces, steel and tank rehabilitation procedures.

Resources. For customers in your area: American Forest and Paper Association, http://www.afandpa.org, Technical Association of the Pulp and Paper Industry, TAPPI (www.tappi.org), Association of Independent Corrugated Converters AICC (www.aiccbox.org), Cellulose Insulation Manufacturers Association (www.cellulose.org), Composite Panel Association CPA (www.cctiwdc.org), Western Wood Products Association WWPA, http://www.wwpa.org, Plastic Lumber Trade Association PLTA http://www.plasticlumber.org, Paper-Pulp conversion industry information http://www.paperonweb.com.

Safety. Pulp paper plant environments require in-house company training for the visiting labor force, including their management and sales forces, as they also prefer to deal with contractors, voluntarily acquiring OSHA's safety protection programs, which can also be area or site-specific. Wearing personal protective gear at all times, and capable of identifying mechanical, electrical and chemical hazards is a prerequisite. OSHA 10 + Contractors safety program provides an insight of what is essential. http://www.wipapercouncil.org. Managing the safety and health

criteria for the employed labor force, safety equipment necessities and protecting customers' labor force and equipment within a job requirement reminds one of the stringent petrochemical plant safety criteria.

APPLICATION REVIEW

Customer, Company: Web site: e-mail:		Date: Nr: Address: City: State: P.O. Box: ZIP Code:	
Purchasing	Engineering	Maintenance	Safety
Tel: e-mail: Area:	Tel: e-mail: Area:	Tel: e-mail: Area:	Tel: e-mail: Area:
Job Description:			
Job Location:	Job Site Risk Assessment:		Specify:
Job Site Review:			

Trade Related Publications:

15. The society for Protective Coatings (2004) The fundamentals of cleaning and coating-concrete, Common mechanisms of concrete deterioration SSPC, http://www.sspc.org [6.28.407]

16. The Society for Protective Coatings (2001) Paint Film degradation, mechanisms and control, Failures related to particular substrates SSPC, http://www.sspc.org [6.28.407]

17. Steel Structures Painting Council (1998) Protective Coatings for Pulp and Paper mills, The Society for Protective Coatings , SSPC, [6.28.407] http://www.sspc.org

Safety equipment and procedures: ©
Tank cleaning, bulk product removal, loading dock and warehouse cleaning services, machine shop floor-grease, oil and coating removal.

WORKSHEET- PURCHASING - SALES

1.23 Power-Plant Service, Coal–Oil and Natural Gas, Combined Cycle, Biomass, Hydro or Nuclear-Powered

In 1958, the design criteria for self-propelled nozzles (Fig. 1.186a, b, c) to clean sewers and industrial pipe installations appeared at a glance to be somewhat associated to the boiler tube cleaning requirement. This was at best an optimistic point of view accelerating in 1959 the development of hp-water tools not yet available on the open market. In 1960, solving specific power-plant applications with registered patented nozzle technologies operating at higher than previously promising pressures in generating lower water volumes, while offering various degrees of jet impact angles was the first approach. This facilitated the cleaning of 1″–3½″ boiler and condenser tubes with ¼″, ½″, ¾″ and 1″ hp-hose assemblies at 25′ to 50′ plus in length. There were technical shortcomings encountered.

Operating between 3,500 psi at 45 gpm and 8,000 psi at 20 gpm utilizing up to 150 horse-power engine performances excessively deteriorated every available hose configuration within a few job applications.

Hp-hose manufacturers scrambled to improve hose abrasion resistance, flexibility in hose structure-radius, weight reduction for two to four layered spiral steel braided and fiber vulcanized and/or Teflon lined assemblies. Hose armatures were also prone to failure and not yet restructured for emerging hp-washing applications or markets. Most often the available hose products maintained internal restrictive hose fittings that compounded fluid pressure drops often identifiable by a nozzle streak pattern developed on tube wall's interior and/or unnecessary repetitious, inadequate cleaning procedures.

Today the motivation to streamline available high-pressure water tools and accessories is to specialize and supplement contractor's application palette in response to possible emergencies or unscheduled maintenance requirements. More often than not, this type of expenditure is only feasible when a dual purpose for such equipment exists. For instance, when furnace feed is of an inferior or inconsistent coal quality combined with (flame) temperature changes which can suddenly accelerate the development of a clinker buildup, jeopardizing the furnaces tube structure and heating capacity, therefore or subsequently putting at risk the bottom grinder and its operation. Clinker removal techniques developed for cement kiln operations can be transferred to a coal-fired boiler-furnace. During operation, periodically reducing the clinker build-up volume in all fired furnace areas will protect the bottom grinder from catastrophic clinker collapse and therefore at a minimum significantly prolong the units operation or avoid a general unscheduled plant shutdown. The thermal shock treatment upon a clinker formation does not jeopardize furnace tube or brick-insulation structures. This application demands a close working relationship with boiler operators, especially while establishing removal schedules and permissible temperature fluctuations (boiler) when performing clinker removal applications. Maintenance department and plant engineering will advise to appropriate lance carrier installation and possible locations found transversely from inspection ports, etc., on cat walk

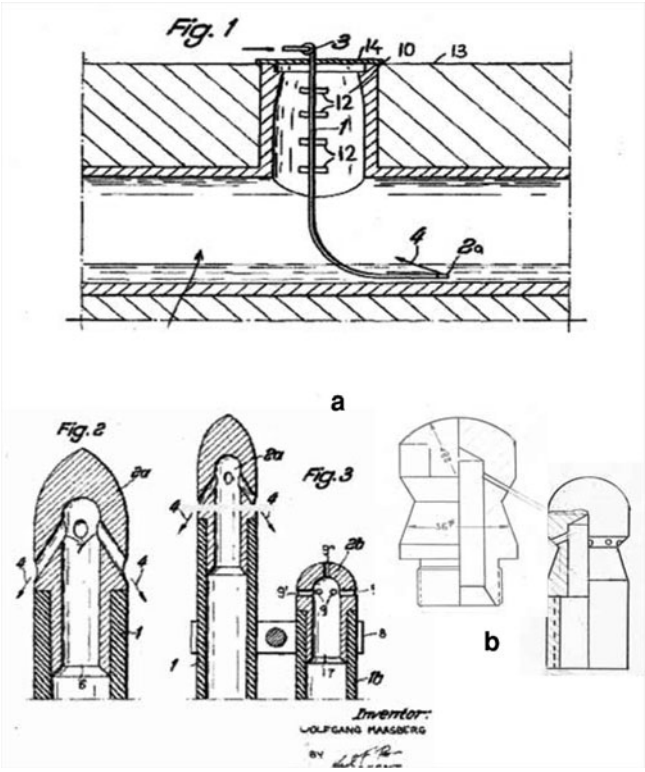


Fig. 1.186 **a** Filed 1958 Germany, 1960 USA patent draft, b 1/4″ and 1/2″ Tube-pipe jetting nozzle 1961, **c** tube-pipe and sewer cleaning nozzle 1958

railings and structural components. This application can also be considered a standby or crisis management capability.

High-heat safety gear and eye protection is also a requirement. The dual purpose for the high-heat lance equipment can be soil rehabilitation, water well regeneration and pipe installation-drilling procedures.

Providing jetting applications in coal washing plants and coal tunnels, cleaning conveyor belts, coal grinders and pulverizing hardware including blow pipes or screens are services considered on the furnaces fuel side and include cleaning particulate air filtration systems, their flue-gas filters, bag house units and pulling fly-ash formations from the boiler top side (Figs. 1.187, 1.188).

Besides clinker removal in fired furnace areas, the accessing of mud and steam drums while in a general shutdown permit the cleaning of all boiler-furnace tubes (Fig. 1.191). Afterward, or as tube repairs are completed, providing hydrostatic test procedures often conclude the necessary furnace-boiler services.

Scheduled are also hp-water cleaning applications within a overhaul process, particularly in servicing emission control equipment and plant hardware concerning the desulphurization process of airborne and liquid waste streams which

APPLICATION REVIEW

Customer, Company:		Date: Nr:	
Web site: e-mail:		Address: City: State:	P.O. Box: ZIP Code:
Purchasing	Engineering	Maintenance	Safety
Tel: e-mail: Area:	Tel: e-mail: Area:	Tel: e-mail: Area:	Tel: e-mail: Area:
Job Description:			
Job Location:	Job Site Risk Assessment:		Specify:

Job Site Review:

United States Patent [19]

[54] **SWIRL JET NOZZLE AS A HYDRAULIC WORK TOOL**

[75] Inventor: **Horst Lingnau**, Duisburg, Fed. Rep. of Germany

[73] Assignee: **Woma-Apparatebau Wolfgang Maasberg & Co., GmbH**, Duisburg, Fed. Rep. of Germany

[21] Appl. No.: **719,419**

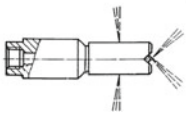
[22] Filed: **Apr. 3, 1985**

[30] **Foreign Application Priority Data**

Apr. 3, 1984 [DE] Fed. Rep. of Germany 3412319

[57] **ABSTRACT**

A swirl jet nozzle as a hydraulic work tool is to be capable of operating reliably as a structurally simple tool, with smooth outer surfaces as far as possible, requiring neither bearings nor seals, so that it is also suitable for cleaning clogged, narrow tubular parts, in particular pipes, with a high-pressure medium and for drilling holes in soft materials. This is achieved by a sleeve-shaped rotor (1), arranged directly above a tapered neck (5) of a stator (2), being provided, which is supported on the stator side on a face (7) of an extended region (8) of the stator (2), preferably via a washer (6) of plastic or the like pushed over the neck (5) of the stator (2), and is axially secured by means of at least one pin (11) engaging tangentially into a circular groove (9) in the neck (5) and borne in a cross bore (10) in the rotor (1).



Providing restricted travel in to desiccated products this hydraulic tool-nozzle is also ideal to slurry calcium and fly-ash formations within clay, asphalt or plastic lined evaporation-settling ponds. Within this application criterion removing slurry or highly viscose products the utilization of hydro-vacuum equipment and vacuum or open roll-off box containers has proven highly successful and superior to alternative industrial vacuum and pumping methods.

Safety equipment and procedures: ©

Cooling tower, bag house unit and mist eliminator cleaning, water treatment facility, boiler and condenser cleaning.

WORKSHEET- PURCHASING - SALES

Fig. 1.187 Fly-ash formations

Fig. 1.188 Boiler top side

Fig. 1.189 Wet/dry interface to scrubber (before)

demand routine and specific attention. Cleaning fixed in place plastic mist eliminator fins on top of the interior scrubber vessel can be achieved and supported by a light metal flex-nozzle carrier. When repair is necessary, cleaning operations are performed on dismantled bundles similar to the in-place air preheater basket cleaning operation. Stack-exhaust shaft cleaning is performed manually or with an automatic hose reel function employing an industrial hp-rotary nozzle and if necessary can be operated with an extended nozzle fixture combined with a water volume configuration accommodating the stacks interior radius. The intake or wet/dry interface to scrubber vessels (Figs. 1.188, 1.189) interior and vessel floor is cleaned by utilizing jetting operations (to knock down and demolish rock hard debris formations to size (chlorides, sulfuric acid remnants, silt-lime-fly ash and calcium sulfate-crust-gypsum), accommodating clean-out procedures by the hydro-vacuum method. Removing scale accumulations in a cooling tower's interior adhering to fan blades, louvers and trays or dredging and pumping lime and fly-ash sedimentations below and/or above water in cooling towers bottom channels are applications requiring hydro-blast equipment and tooling operating at

Fig. 1.190 Hydro-blast operation

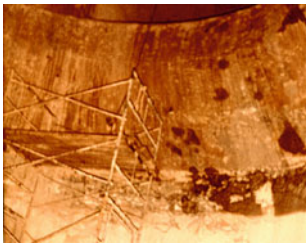


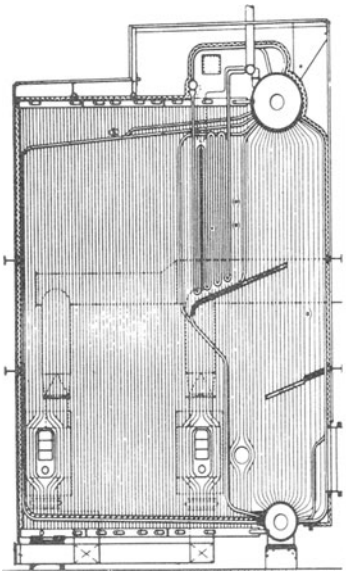
Fig. 1.191 Wet/dry interface to scrubber (after)

75–150 hp. Vacuum roll-off box containers or an optional vacuum waste-product separator unit and water trucks are also utilized (Fig. 1.190).

Slurrifying calcium and fly-ash formations within evaporation-settling ponds lined with clay, asphalt or plastic, and removing these sedimentations by employing the hydro-vacuum method has proven to be highly successful. The established comparison is to otherwise engage high velocity vacuum tractors producing up to 6,800 CFM in combination with mechanical means such as backhoes or pick and shovel shared with fire hose operations. In contrast, an 80-yard box can be loaded continuously in 10–20 min with the hydro-pump process preventing damage to the evaporation pond's liner.

High velocity water quantity above 800 mph and its submerged nozzle standoff distance to thickened, semi dry or dry material being agitated will most often not exceed 5% of its product volume pumped. This figure of adding 5% water is high and can be less varying on moisture content of product. As of today, no faster or effective dredging and removal method above and below water is available (lime, gypsum, fly-ash) (Figs. 1.192, 1.193, 1.194 and 1.195).

On the steam side, cleaning interior main condenser tubes and shell side exterior tube structure, tube shield, including gasket areas (when pulled bundle surfaces are exposed) is today considered a generally matured application identity. Specialized is the flushing, cleaning and preservation of turbine lube oil systems which include cleaning lube oil tanks, compressor housing cavities, pressure-discharge lines and vertical integrated oil cooler units with drip or splash proof equipment facilitating a 4–9 tube per minute cleaning rate (Fig. 1.196). This work



Figs. 1.192 and 1.193 Coal-fired steam generator (1.192). Cooling tower, mist eliminator, stack (1.193)

Fig. 1.194 Coal-fired power plant

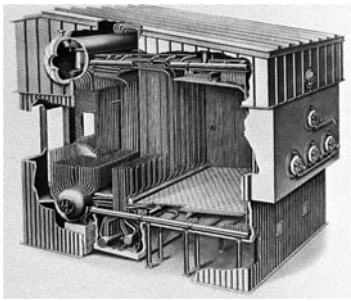


Fig. 1.195 Oil–gas, Steam generator, steam–mud drum

Fig. 1.196 Condenser cleaning, open splash-proof

Fig. 1.197 Combined cycle plant

is performed with demineralized water or filtered, recycled heated light-lube oil customary to plant operations.

The natural gas combined cycle power plant operates gas turbine generators with a heat recovery steam generator, capturing heat from the gas turbine exhaust. The steam produced in the heat recovery steam generator system powers a steam turbine generator to produce additional electric power. Various plants operate gas-oil, dual-fuel fired furnace-boiler hardware requiring light distillate fuel oil as backup fuel, which is often trucked into be stored in adjacent tank farms. Natural gas combined cycle power plans (Fig. 1.197), also require low water volumes between steam and hot water cycles. Water losses consist mainly of steam and water leaks throughout its closed loop system.

Fig. 1.198 Fin-fan heat exchanger, combined cycle plant

The feed water quality standards for drum type boilers (Fig. 1.195) to control the potential of contamination and deposits and/or corrosives is high. Plant waters necessary and destructive elements are measured in parts per billion (ppb). Control measures are in place to avoid excessive boiler tube and turbine fouling and/or minimizing the potential for stress corrosion and possible cracking of turbine blades. The main source of contamination is corrosion (chemical), mechanical or system malfunctioning and/or contractor contaminating a plant system's interior due to an inadequate maintenance or cleaning procedure.

When in high-pressure water cleaning process, completely removing dislodged contaminants must be a job description as must be the identification of reliable and approved corrosion inhibitors. Main condenser, intermittent and after condensers, air cooled heat exchangers, HRSG fin-fan tube cleaning (Fig 1.198), rotary air preheater baskets, economizer, evaporator, vacuum deaerator and flue gas scrubber services as well as cleaning the make-up water system and it's reservoir or hydro cleaning by flushing the entire turbine and compressor lube oil system are all service applications performed by today's qualified contractor.

In attempting to reduce our reliance on traditional fossil fuels, fuel manufacturing capacities for ethanol and bio diesel facilities are added nowadays to the agricultural services environment. The current and emerging liquid bio fuel technology converting natural oils to bio diesel or sugars, starches and whole-grain into ethanol, generates more rural business potentials for local service companies. This process utilizes the agricultural waste-biomass (fired boilers) for steam generation supporting processes and/or converting it to electric power which is especially obvious in various sugar-cane, paper-pulp and engineered wood manufacturing industries. The biomass fueled boiler and its turbine arrangements can vary drastically in size, airborne particulate-pollution control and in wastewater treatment facilities' design specifications. Maintenance necessities vary depending on type of fuel being processed and burned.

Hydroelectric power generation (Fig. 1.199a, b) and their natural plant locations yet again favor the rural service provider in a variety of possible applications not necessarily linked to power generation. Hydropower is still the most widely used form of renewable energy. It does not produce carbon dioxide or any other waste which may result in the accumulation of excessive scale or corrosion problems generally considered a service providers life blood. Controlling structural steel and concrete deterioration by supporting a possible concrete restoration or coating-painting application can be a periodic procedure.

Fig. 1.199 **a**, **b** Hydroelectric power generation

Fig. 1.200 Spillway

Cleaning and/or surface preparations prepping the plant water intake, trash racks, penstocks waterline surfaces and cat-walk grates or interior valve assemblies, mechanical control-lock mechanisms on spillways (Fig. 1.200) and sometimes the underground surge chamber can from time to time be an expected service requirement. The multi-use water dams providing agriculture irrigation, flood control, upstream water sport facilities such as pleasure craft services, fishing, camping and general tourist amenities are areas where contractors will find their entry-level application curriculum applying high-pressure water and tooling up to 5,000 psi.

Decontamination techniques for nuclear power plant processes and methods are somewhat of a classified nature. There is a broad application range and technologies available. Combining contractors' possible applications criteria, with plant maintenance and engineering specifications under plant laboratories guidelines requires meticulous planning. Radiation protection, minimizing radiation exposure, working within rules for decommissioning-decontamination of commercial facilities that apply radioactive materials also provide a diverse customer variety. This includes the performance of services in medical institutions as well as universities, non-weapons related government-private laboratories and their manufacturing sites and/or accident locations. Activities in these areas can support and develop necessary qualifications for job opportunities when cleaning-decontamination-decommissioning activities in nuclear power plant facilities are made available. The possible variety of work justifies the training requirement and

related costs for radiation workers, controlling dose limits and establishing a dose history database for them. Code of Federal Regulations (10 CFR Part19) and (10 CFR Part 20) standard for protection against radiation by establishing the dose limits for radiation workers provides the guidance for all involved. This service activity is most always considered a hazardous waste removal application. Job duties will include the correct disposal of various cleaning materials such as dry or liquid broad-spectrum adsorbent products applied in a decommissioning or decontamination procedure as well as cleaning and decontaminating dismantled structures, equipment and soils which remain minimally contaminated but can be disposed of as low-level radioactive waste. Decommissioning-decontamination procedures can include dismantling equipment and structures and/or an environmental restoration of affected surroundings. This work is performed by qualified and periodically tested hazardous material removal workers which through experience may well become qualified decontamination technicians advancing their capabilities to radiation-protection technician. The periodically tested radiation-protection technician (lead man) is aware of decontamination regulations, guidance and communications, and capable of applying radiation test methods and tooling, including operating survey meters to locate, identify and evaluate possible radioactive materials. The radiation-protection technician also controls the correct high-pressure water cleaning and equipment operation which includes Hydro-vacuum equipment, its application and combined HEPA filtration systems when servicing primary and secondary facilities. Performing an exact decontamination procedure and appropriately packaging high and/or low-level radioactive waste materials in primary and secondary containment areas for transportation, controlling the process of verifying disposal treatment, which can include transportation to landfill or storage facilities in dry or liquid form and/or incineration, belong within these application criteria.

The manual hydro-blast FGD stack cleaning operation, most likely removing acidic residue, deemed hazardous, adhering to general interior surfaces and various structural cavities including flange exhaust chamber are nowadays displaced by quick-install automated equipment available for this application. This equipment can also be utilized for elevator shaft; laundry and refuse chute cleaning operations in high-rises, etc.

The operating longevity of hydro-electric power plants often demonstrates the creeping concrete surface deterioration brought upon by general environmental conditions. Carbonation (salt) resulting in physical damage to various degrees into concrete and possible block surface structures accelerates in-depth the decay during natural weathering cycles. These deteriorating weather cycling events can be effectively slowed and controlled by periodic cleaning and sealing concrete-block surfaces in depth before extensive rehabilitation events are necessary. Often a past neglected maintenance procedure forces the securing of such structures by Hydro-concrete rehabilitation and sealing measures which nowadays present a major business capacity within this field. Besides the Hydro-demolition-rehabilitation or UHP concrete removal application, utilizing the water abrasive blast technique is of an advantage, providing a near zero environmental impact while

APPLICATION REVIEW

Customer, Company: Web site: e-mail:		Date: Nr: Address: City: State: P.O. Box: ZIP Code:	
Purchasing	Engineering	Maintenance	Safety
Tel: e-mail: Area:	Tel: e-mail: Area:	Tel: e-mail: Area:	Tel: e-mail: Area:
Job Description:			
Job Location:	Job Site Risk Assessment:		Specify:
Jo Site Review:			
Safety equipment and procedures: ©			
Scrubber unit and interior stack cleaning, sludge removal in cooling tower channels, plant water and evaporation ponds.			

WORKSHEET- PURCHASING - SALES

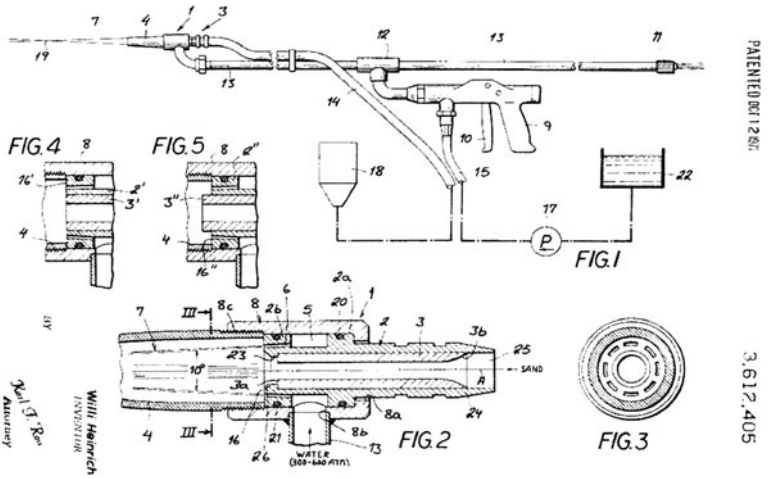


Fig. 1.201 1960–1967 Patent file

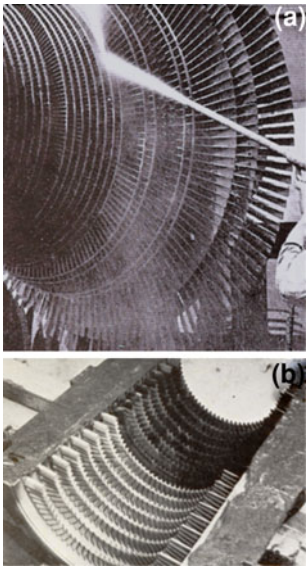


Fig. 1.202 **a**, **b** Housing and turbine runner

performing an industrial rated surface preparation. Most importantly, this application does not entail more than 75 hp input, which under most circumstances far exceeds essential concrete surface preparation prerequisites.

Industrial abrasive water-blast techniques and equipment (Fig. 1.201) were first applied in power plant industries and fine tuned for steam turbine or compressor cleaning operations in the early 1960s by removing the general film fouling and hydrocarbon scale. Aluminum oxide powder admixed with high-pressure water

APPLICATION REVIEW

Customer, Company: Web site: e-mail:		Date: Nr: Address: City: State: P.O. Box: ZIP Cod	
Purchasing	Engineering	Maintenance	Safety
Tel: e-mail: Area:	Tel: e-mail: Area:	Tel: e-mail: Area:	Tel: e-mail: Area:
Job Description:			
Job Location:	Job Site Risk Assessment:		Specify:
Job Site Review: (a) (b)  Fig. 1.203 a.b Pipe and Tube-bundle cleaning ½" and ¼" Nozzles 1961			
Safety equipment and procedures: ©			
Oil lube cooler, oil lube tank, fin fan tubes, hydrostatic testing, cleaning trash rack, cat walks and concrete surfaces.			

WORKSHEET- PURCHASING - SALES

Fig. 1.203 a, **b** Pipe and tube-bundle cleaning ½" and ¼" nozzles 1961

was utilized to remove film like deposits on turbine blades. This application is nowadays more often effectively controlled and performed through applying inhibitors (chemistry) to boiler feed water and/or chemical cleaning procedures.

Admixing powders and various sized granules to a well designed high-pressure water stream should not be a forgotten tool identity (Fig. 1.202a, b). The often superior surface honing, polishing, rust-paint-coating removal and overall surface preparation potential can support a specialized application itinerary which should never be underestimate in its repetitious profitable business potential.

Contacts. Power plant maintenance engineering and purchasing departments, retrofit service companies, providing coating-liner installations and plant hardware for sub contractor status. Area coal mines, and Google for information, "power generation facilities".

Safety. Service providers involved in electric power generation facilities will provide a tested labor force qualified in providing clear lines of communication with maintenance and plant safety departments, operating confined space entry equipment, air monitoring and continuous atmospheric testing, identification of potential physical hazards, lockout-tag-out procedures, fire prevention, etc. Hp-water applications generally require a combination of controls in this environment (Fig. 1.203).

For nuclear power plant services, US Department of Energy, maintenance management programs and labor force training, 10CFR 830, Subpart B, and DOE G 433.1-1 and DOE technical standards program web sites, http://www.hss.energy.gov/nuclearsafety/nsps/maintenance.html. Office of nuclear safety and environment, establishing requirements and guidance to ensure health and safety for workers which is not a department of OSHA, Interfaces & Liaisons, DNF-SB (Defense Nuclear Facilities Safety Board, EPA (Environmental Protection Agency), IAE (International Atomic Energy Agency), NRC (Nuclear Regulatory Commission), OSHA (Occupational Safety and Health Administration).

1.24 Railroad-Commuter-Light Rail Maintenance Yards, Railways Historical Associations, Theme Parks, Rail Bridge, Steel–Concrete Rehabilitation, Rail Accident, Site-Emergency Response

In the early 1900s, pump manufacturers designed and delivered in-house cleaning systems and rudimentary equipment combining a water-steam function to more successfully remove grease, oils and other contaminants from railcars and locomotive surfaces. Early on, manually operated wands applying 2.5 and later up to 25 hp were utilized to clean engine parts, truck-axle assemblies and the exterior-interior of railcar tanks, etc. There is no doubt this water-steam cleaning capability presented a marvelous tool addition to any rail yard facility. Drive-through wash bays and today's integrated sumps, separating oil-grease and solids from waste streams, were later incorporated.

Regardless of the fact that in 1821 James Boyd patented the first rubber-lined, cotton-webbed fire hose assemblies, and Charles Goodyear discovered in 1839 the

all-important rubber vulcanization process (1844 Patent) modernizing the emerging industrial hose manufacturing technique and followed in 1878 by seamless cotton woven fire hose units (American Fire Hose Company), the high-pressure water hose and nozzle technology above 1200 psi did not yet exist to permit the cleaning of boiler tubes in steam engines. Tubes were manually routed with push rods and later with rotary steel brush systems. The American Fire Hose Manufacturing Company also advertised first in1900 hose-reel and fire hose nozzle assemblies. The reinforced industrial hose construction was made possible by converting yarn braiding equipment. Steal-wire braiding, intended as hp-hose reinforcement, was introduced in the mid 1920s. By 1930, industrial braiding equipment delivered hoses in length of up to 20 m. Textile braiding technologies were tailored to the steal-braiding curriculum and combined with existing vulcanization techniques resulting in production of hose assemblies for hydraulic automotive brake systems, appearing in the early 1930s. These hose assemblies were successful in maintaining semi static pressures only and required a substantial technical improvement before service for reciprocating pumps exploiting the pressure washing, sewer cleaning or hydro-blast cleaning application became possible (500 pump rpm plus).

In the late 1950s, the introduction of high-pressure water-jets and nozzles to existing low pressure stationary drive-through facilities (1,250 psi) for exterior locomotive and railcar cleaning procedures (Fig. 1.204a), similar in appearance to today's car-bus-tractor-trailer cleaning systems, proved contrary to prior belief somewhat futile. The thin-film residue removal application, especially on painted or lacquered glossed surfaces, proved inadequate when safely utilizing high-pressure water fan-jets. Only by adding various water temperatures and detergents to the stationary stepped fan-jet assemblies, combined with the introduction of a physical friction to surfaces in question, was the removal of statically adhered and/or carbon-oil-film deposits successful. These semi automatic cleaning systems operate within the 100–300 plus horsepower range. The labor-intensive washing-scrubbing method was finally displaced by incorporating hydraulic-electric driven rotary brush or oscillating rag scrubbing systems.

With a combined fleet of 7500 plus locomotives throughout the United States, railroad companies annually perform hundreds of overhaul and repair procedures. So-called "back shops" (Fig. 1.204d, e) of engines. These facilities provide major repair work which generally includes the complete disassembly and rebuilding of engine and power-train assemblies including exterior deteriorated coating removal-installation practices. These activities are also performed while actively reducing prior pollutant loads from their maintenance operations and paint job facilities.

Today, waterborne coatings with highly reduced solvent levels (VOCs) combined with a clear coat system find their way onto locomotive surfaces. Under various going-green programs high-pressure water cleaning applications, coating removal techniques and the introduction of wastewater-recycling and filtration methods reducing or eliminating the waste burden to the environment, can be considered an innovative application frontier for modern service companies.

APPLICATION REVIEW

Customer, Company: Web site: e-mail:		Date: Nr: Address: City: State: P.O. Box: ZIP Code:	
Purchasing	Engineering	Maintenance	Safety
Tel: e-mail: Area:	Tel: e-mail: Area:	Tel: e-mail: Area:	Tel: e-mail: Area:
Job Description:			
Job Location:	Job Site Risk Assessment:		Specify:
Job Site Review:			
Safety equipment and procedures: ©			
Rail-tanker cleaning, paint-coating removal, livestock-car cleaning and sanitizing.			

WORKSHEET- PURCHASING- SALES

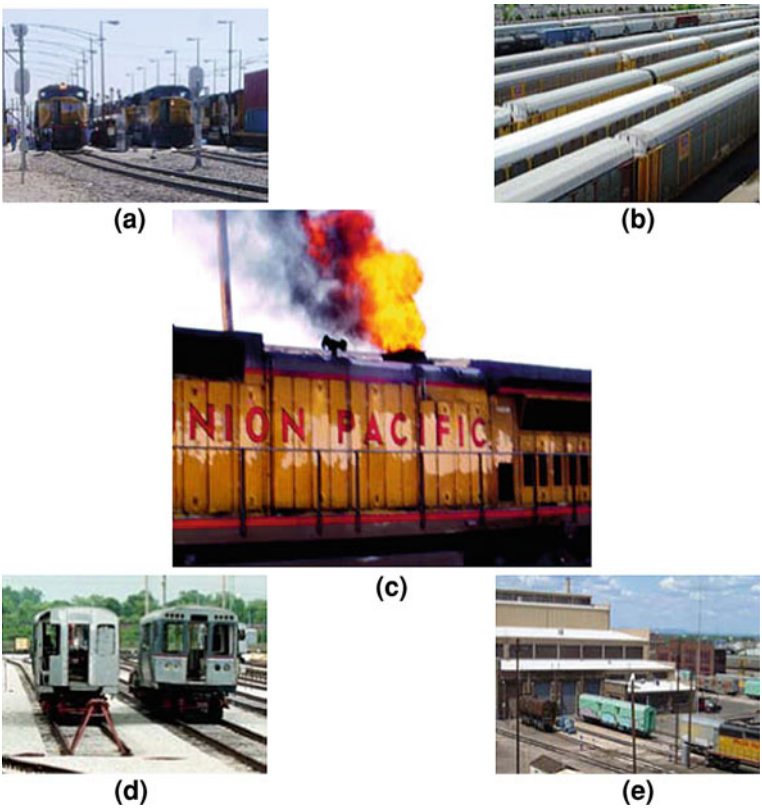


Fig. 1.204 **a** Fuel station, **b** Rail yard, **c** Burn-off after extended engine idle, **d**, **e** Back shop

In general, locomotives are the only cars that represent the railroad company itself. The reporting Mark is an identification assigned by the Association of American Railroads (AAR) to rail carriers and other companies operating in North America. They are the letters in sequence of two to four, visually and uniquely identifying the owner of railroad rolling stock (locomotives-cars). Freight cars owned by leasing companies do not necessarily exhibit a Railroad Mark.

The type of car in need of cleaning and/or sanitation services and/or coating removal applications will often in itself identify the industry and company it services, as for instance gondolas transporting bulk commodities such as aggregate, coal, minerals, scrap or steel products. Open top hoppers are also designed for bulk commodities, such as coal, coke, aggregate or sand and livestock cars operate between cattle yards and slaughterhouse-meat processing operations and/or transporting zoo or circus animals to their awaiting fairgrounds. Livestock cars may also require a biologically controlled cleaning procedure. Flat cars transport steel, lumber and other finished heavy industrial products, as auto-rack cars transport vehicles from manufacturing location to their destinations throughout the

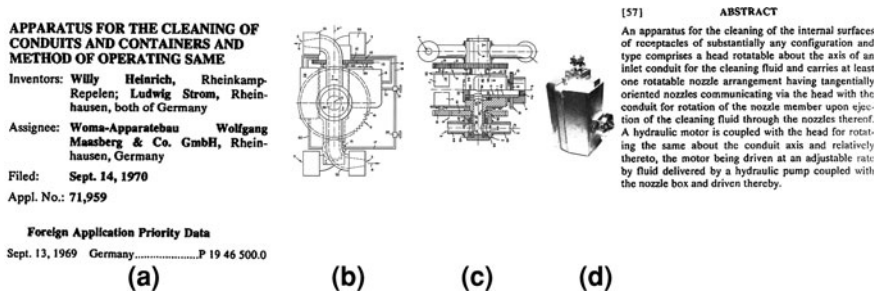


Fig. 1.205 **a** Paten file 1968, **b**, **c** 6500 psi.3D nozzle, patent draft, **d** 6500 psi.3D stainless steel nozzle, **e** patent abstract

country. Boxcars accommodate the broadest range of manufacturer or shipper needs. They may transport packaged food, auto parts, appliances, forest products, building materials and so forth and generally require the least attention in cleaning procedures and coating replacements. This differs substantially to refrigerated cars-tankers transporting food-stuffs, liquid and meat and/or volatile dry or liquid chemicals. These railcars specifically fall under the regulatory compliance management for freight and tank cars and demand a variety of cleaning-sanitation options for maintenance inspection and certification (e.g. HM201).

Tank car cleaning applications naturally performed one way or the other were automated in the early 1930s, applying low pressure high water volume rotating nozzle equipment (Butterworth 1925).

Problems arose more often within delivery and sanitation cycles of foodstuffs and chemical products tending to adhere to interior tank surfaces, or when frequent cleaning intervals due to product changeover and general business growth throughout the industrial environment escalated (Fig. 1.205a, b, c). Equipment manufacturers hustled to develop and manufacture 3D nozzle capabilities, performing with lower water volumes at higher pressures 5–8,000 psi plus and made them available in the mid 1960 (Fig. 1.206).

The 3D nozzle technology was quite difficult to develop. There were no technical examples or other expertise to draw from. Fluid seal technology for rotating high-pressure water equipment (5,000–10,500 psi) controlling the required or desired nozzle rotation (rpm) for various application necessities presented a definite engineering challenge.

Providing specialized services for rail maintenance departments, independent terminals and private railcar owners can include activity in rail and trucking facilities, or light rail transit yards and their maintenance operations and providing services to subway or similar transportation identities. This includes cleaning underpass and tunnel structures or servicing product holding tanks, fuel tank-farms or wastewater treatment facilities, evaporation-settling ponds often located in rail yards, customer's storage and loading areas. Cleaning applications require generally 2,000–8,000 psi at various water volumes which permits grasping the bulk of available service work.

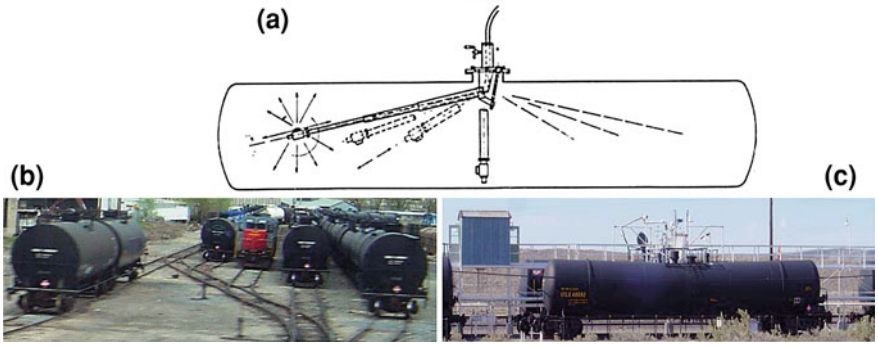


Fig. 1.206 **a** Telescoping 3D tank-cleaning assembly, **b** Private tank yard, **c** private fill and maintenance facility

The hydro-vacuum, water-abrasive blast and UHP equipment identities will provide an array of possible applications permitting specialization within this field. Coating and lining removal applications on interior-exterior steel railcar surfaces designed for acid, alkalis, dairy, hydrocarbons and livestock transport is an area where the UHP application rules. This, particularly within the presence of an existing anchor profile which permits an immediate spot coating-maintenance or installation procedure while performing within environmentally permissible regulations.

Private railcar owners may also require pressure washing services for their unit-trains (Fig. 1.207a, b) in their facilities or on their maintenance tracks. Units are in general comprised of 30–125 rail cars in need of pressure washing services completed within 2–3 day shift assignments. This requires an approved acid-detergent-rinse application cycle and the employment of a secondary spill containment, track pans or a pan system combined with a mobile water filtration and recycling function permitting the removal of waste-water by shifts end. This application can somewhat be compared to tractor-trailer fleet cleaning operations, where a complete unit is serviced between 8 and 12 min. This requires a highly organized and systematic work method, leaving nothing to chance. The timely utilization of an aerial lift, supply and application of acid-detergents including the necessary rinse cycle, blast water replenishment and effluent pickup is precisely choreographed. Simultaneously, a correct rail safety and signage procedure and the wearing of safety gear, respirators, etc., must be mandated. This is challenging due to job location, the graveled rail and unsecured shoulder surfaces, length of railcar units, cleaning equipment turnaround procedures and providing a strong labor force which will most likely vary between job locations as well as the encountered weather.

The entrepreneur will find the restoration of locomotives and their respective cars quite educational, in particular due to the fact that restoration work must meet the stringent safety rules (Fig. 1.208) established by the Federal Railroad Administration (FRA). This includes performing a correct confined space entry

Fig. 1.207 **a** Rail equipment, **b** private unit train cars

procedure, providing personal protective gear (PPE), enforcing HASMAT regulations and furnishing MSDS identification for all chemicals introduced to the jobsite. These guidelines are often compromised by overeager volunteers supporting the railroad historical society. Contractors do best when comparing existing volunteer work with prior work performances, showing specific time savings achieved with available equipment capabilities and resulting final surface appearances. Needle gun operations, steam cleaning, and pressure washing

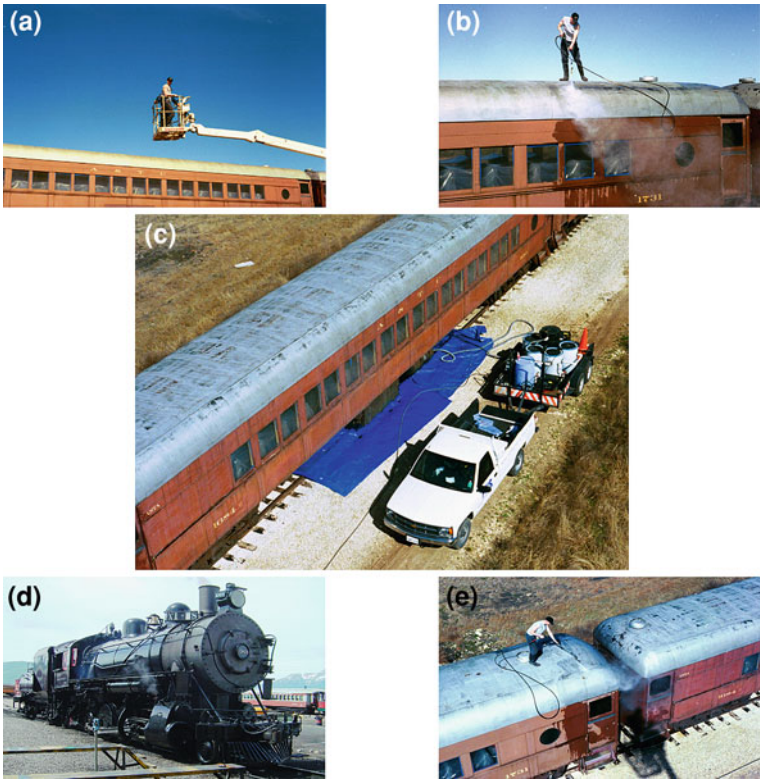


Fig. 1.208 **a–e** Roof access, **c** water recovery-filtration-recycling, **d** locomotive restoration yard

practices conducted with less than 18 hp., including air abrasive blast techniques, are inconsiderate maintenance solutions with environmental impacts unbefitting historical societies, theme park operations, etc.

Cold-weather cycling combined with salts and acidic environmental conditions resulting today in advanced carbonation effects (Fig. 1.209) on bridge components, corroding and degrading not only steel decks but also the supporting concrete structure. This again justifies utilizing UHP concrete removal practices in reaching below the rebar structure, avoiding further rebar deformations and the introduction of micro fractures to the remaining robust concrete substrate customarily produced when air-electric operated jackhammers are engaged for concrete removal operations.

The rehabilitation of aging rail decks and bridge structures is an ongoing business opportunity with no end in sight. Deteriorating concrete and steel decks beneath the rail rock ballast are a constant maintenance concern (Fig. 1.209a) to specifying engineers, transportation departments and transit authorities. After removing the rail section and rock ballast, water abrasive blasting or the UHP application technique is utilized to remove the cavernous corrosion accumulations

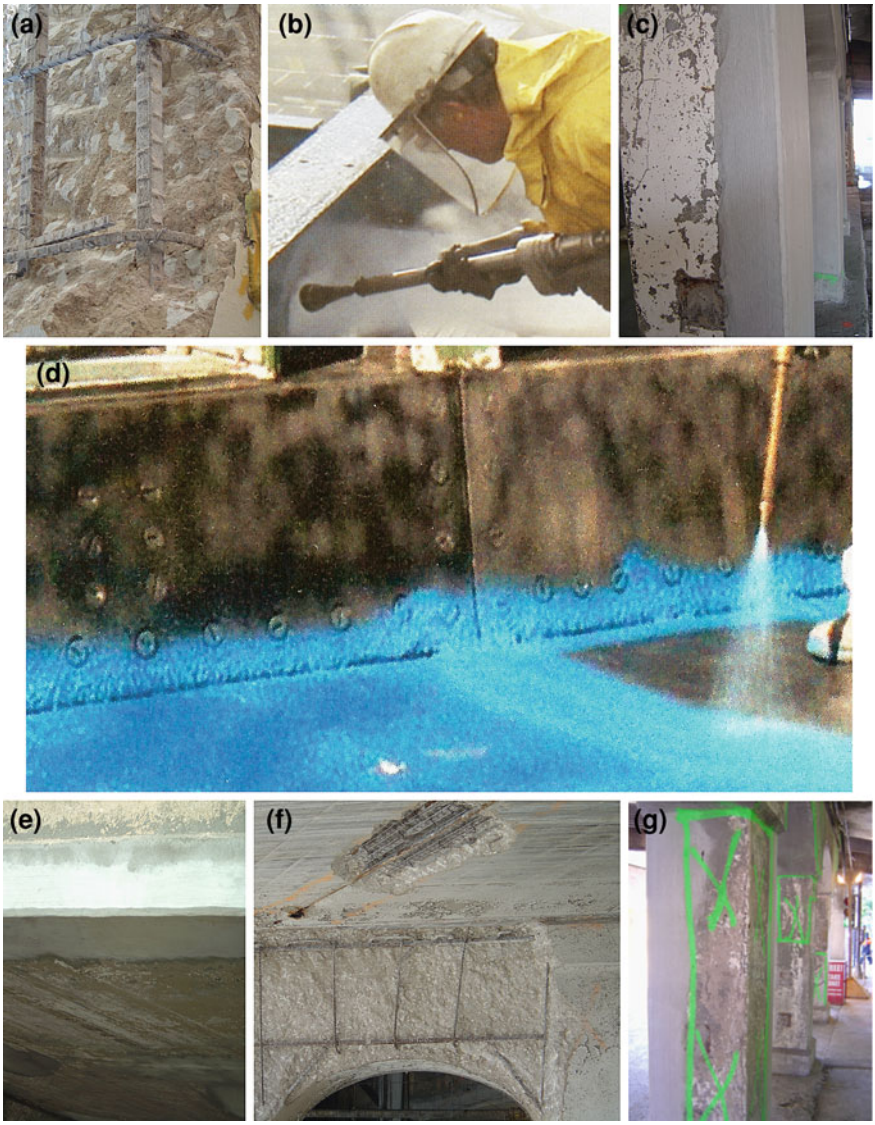


Fig. 1.209 **a** Removal of advanced carbonation, **b** 40000 psi UHP coating removal, **c** Repaired carbonation damage, **d** coating procedure, rail bridge deck, **e** repaired concrete carbonation, **f** removal of advanced carbonation, **g** damage removed and repaired

which generally are shared with the simultaneous removal of a failing coating system. Care must be taken to correctly identify the existing coating. Blast water and refuse lead based coatings are rendered harmless by utilizing water vacuum-recycling and retrieval-filtration equipment, separating solids, followed by water treatment through recycling the polished effluent via a phosphoric filter assembly

APPLICATION REVIEW

Customer, Company: Web site: e-mail:		Date: Nr: Address: City: State: P.O. Box: ZIP Code:	
Purchasing	Engineering	Maintenance	Safety
Tel: e-mail: Area:	Tel: e-mail: Area:	Tel: e-mail: Area:	Tel: e-mail: Area:
Job Description:			
Job Location:	Job Site Risk Assessment:		Specify:
Job Site Review:			
Safety equipment and procedures: ©			
Servicing waste water treatment facilities, dredging evaporation ponds, fuel-oil tank cleaning, machine shop services.			

WORKSHEET- PURCHASING - SALES

before discarding or returning the water to the UHP suction side. This operation can be a stepped procedure between UHP blast cycles, general repairs such as welding, and the elastic thick-film coating installation, resulting in the water proofing of rails underlying steel decks. Flagmen will guard and warn crews from oncoming trains. Passing rail traffic can be quite disruptive, producing air pressure and windswept hindrances forcing tie-down procedures of all equipment and expendables (tarps, etc.)

Rail safety must be precise and often involves night work without the disruption to rail traffic. Railcar accidents where spill control and subsequent spill removal applications occur are almost always classified as an emergency response application. Streamlining high-pressure water tools to support various emergency response criteria can be of considerable interest, especially given that this tool variety is also employed for far-reaching disaster cleanup procedures (fire, flood and vehicular accident cleanup-remediation-restoration). In the absence of mechanically generated heat, spark and or compression within the product transfer process, the hydro-vacuum equipment characteristics provide a superior industrial product removal capacity under adverse circumstances and isolated conditions. To safely transfer product within a potentially explosive, volatile, flammable, acidic, viscous or powder-granular state is its undisputed performance hallmark. While loading railcars, tanker trucks or industrial transportation containers, adding a HEPA air filtration capability will further be advantageous. Contractors wishing to enter the emergency response field utilize an equipment response unit which also consists of chemists operating a mobile laboratory to identify the nature of a spill and the hazardous classification group of chemicals and products involved. Because of an accidents possible location, fluencies and involvement of various emergency responders and/or catastrophic environmental impact, these operations are not compared to remediation procedures performed on Superfund sites, etc., when cleaning, packaging and transporting the identified hazardous wastes to a designated facility.

Contacts. Railroad inspection, construction and maintenance services for subcontractor status. Train, subway and transit car manufacturing industries, their purchasing and maintenance superintendents, railroad companies state transit authorities, railroad maintenance plant (back-shop) and track maintenance superintendents, railcar leasing and management companies, rail freight shipping companies, their warehouse and storage facilities maintenance superintendents, railcar fleet leasing and inspection services. Also contact one-stop railcar service companies performing railcar cleaning, mechanical repairs and interior-exterior finishing services and private industrial railcar owners in agricultural, food, automotive, mining and petrol-chemical environment, etc.

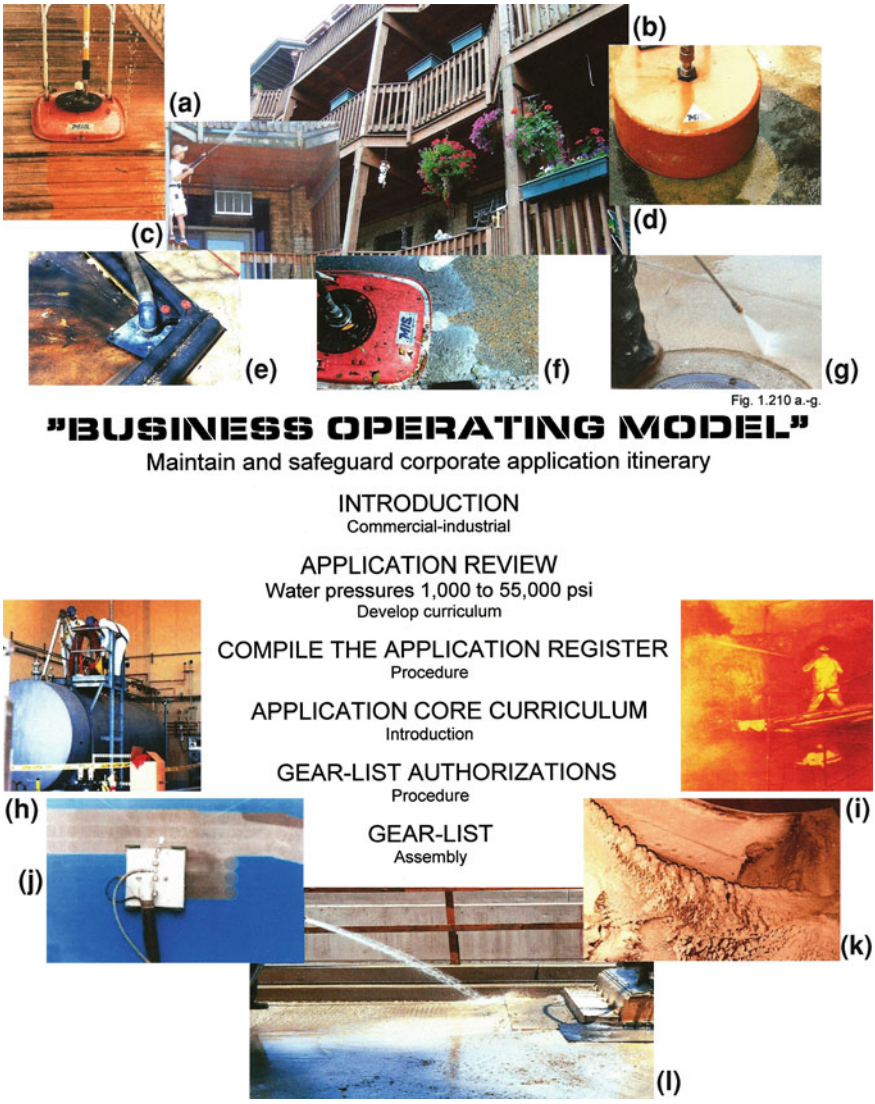
Resources. AREMA, the American Railway Engineering and Maintenance-of-Way Association, http://www.arema.org ASLRRA, American Short Line-Regional Railroad Association http://www.aslrra.org, On the Internet, “Historic railway associations”, AAPRCO, American Association of private Railroad Car Owners, etc. NARCOA-North American Railcar Operators Association, http://www.narcoa.org, etc.

Safety. Workers complying with the Federal Railroad administration will require training and testing to qualify as a roadway worker. Required safety training involves general safety awareness and understanding the "ABSOLUTE NO-FOUL situation or activity, FRAs, On-Track safety program, Steel bridge inspection and safety regulations for railroads, bridge worker protection program, roadway worker protection, 49 CFR, Part 214, Subpart C., General safety regulations R920-51, safety regulations for railroads, title 49 Federal Railroad Administration, applying to all private, common and contract carriers by rail. Railroads safety program administrator provides contractors with a source list for available safety training programs. OSHA's hazardous waste operations and emergency response (HAZWOPER) training, including DOT-HAZMAT transportation labeling and placarding training under 49 CFR 172.704, OSHA, Site Supervisory Training, 29 CFR1910.120, EPA's Hazardous waste management programs 40 CFR 262.34& 265.16, and HAZCOM, Hazardous communications training, 29 CFR 1910.1200 are next to necessary tool and application capabilities the minimal basic qualifications a contractor will produce or utilize on a jobsite. Most jobs and applications within this field require a combination of safety procedures (Figs. 1.210, 1.211 and 1.212).

APPLICATION REVIEW

Customer, Company: Web site: e-mail:		Date: Nr: Address: City: State: P.O. Box: ZIP Code:	
Purchasing	Engineering	Maintenance	Safety
Tel: e-mail: Area:	Tel: e-mail: Area:	Tel: e-mail: Area:	Tel: e-mail: Area:
Job Description:			
Job Location:	Job Site Risk Assessment:		Specify:
Job Site Review:			
Safety equipment and procedures:			©
Unit-rail car cleaning operations, steel deck coating removal, concrete rehabilitation procedures.			

WORKSHEET- PURCHASING - SALES



Figs. 1.210–1.211 **a** Overhead wood cleaning, **b** balcony-deck cleaning, **c** manual Spin-Jet operation, **d** moss-fungus removal, **e** wastewater recovery, v-shoe, **f** flat-work, floating Spin-Jet, **g** concrete, flat work, **h** Tank-cleaning, top entrance, **i** confined space hydro-blasting, **j** vertical coating removal, **k** stack interface before, **l** concrete sacrifying

1.25 Business Operating Model

1.25.1 Retain and Safeguard Corporate Application Itinerary

Protecting service providers managerial and operational business future is essential, as is streamlining the recurring business opportunities within the pressure-washing, hydro-blasting, hydro-vac and UHP application criterion. Confidentially attaining the corporate identity is achieved when correctly accruing past and future job histories, avoiding the loss of application technology and know-how to various and often repetitive circumstances. The software-manual supports commercial and industrial buyers and their corresponding persons in that a final job procurement result, and the narration of an application method, including the billing process is independently produced and processed. Maintenance and civil engineers, paint-coating specialists, architects, restoration or preservation consultants, industrial maintenance superintendents and/or entrepreneurs are provided with a managerial method to correctly record and analyze an application prerequisite within their respective field including the agricultural-aquatic, commercial, industrial and marine environment.

The industrial documentation provides general high-pressure water cleaning, hydro-vac dredging or bulk refuse-product removal procedures for settling ponds, industrial tanks, sewer or industrial tube-pipe jetting services, including the cleaning of manufacturing hardware, and paint-coating removal endeavors. Steel cutting, concrete roughening or demolition applications, etc. are techniques also depicted.

The software-manual's commercial environment recognizes the know-how of general surface cleaning applications (flat-work) on vehicle garage, drive-thru, machine shop and warehouse surfaces, etc. and introduces façade cleaning and rehabilitation procedures on various substrates including composite and stone, masonry, concrete, brick or wood surfaces.

1.26 Introduction

Applications within the agricultural, marine, commercial, industrial, and residential criterion utilizing tool identities powered and manipulated by high-pressure water. Specific safety measures, contact and resource information has been outlined for all included industries. The trade "application review" form is applied by professionals to revise and upgrade the "introduction" manual with every new application encountered, thus expanding manual's content. Recording the job analysis will identify and provide a guide to a variety of application methods within the application "index" chapter.

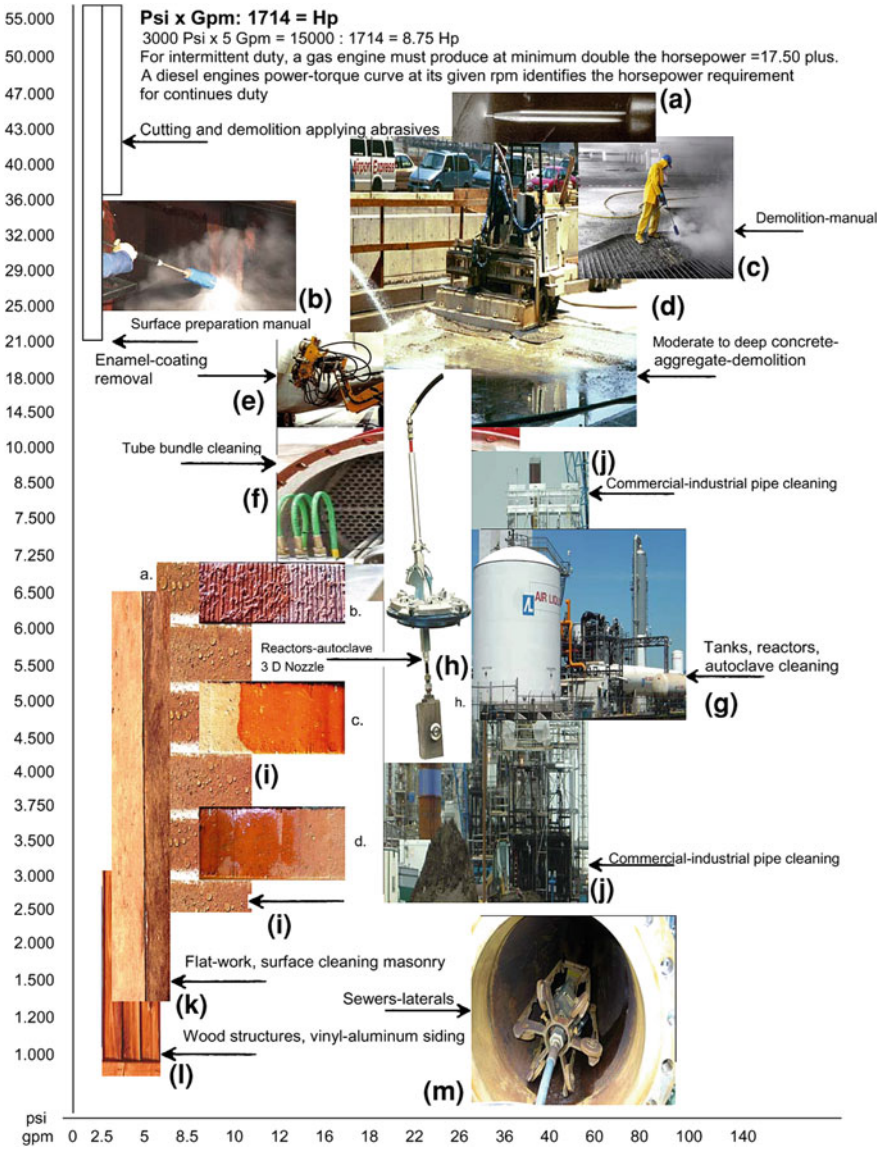


Fig. 1.212 **a** Abrasive UHP cutting, **b** demolition-manual, **c** surface preparation manual, **d** concrete-aggregate demolition, **e** enamel-coating removal, **f** tube bundle cleaning, **g** tank reactor, autoclave cleaning, **h** reactor, autoclave 3D cleaning, **i** brick–block–stucco cleaning, **j** commercial–industrial pipe cleaning, **k** flat-work, **l** wood structures, vinyl, aluminum, **m** sewers and laterals

1.27 Application Register

Corresponding to over 450 specific job entities, more than 25 core applications are described within the commercial, marine, and industrial environment. When a necessary application curriculum is recognized, the revealing "Register" numbers are branded by business and industry identification, manufacturing hardware or process, service industries identity or its practice, type of product to be removed, area identification, or environmental and disaster terminology. The application "Register" is expanded or fine-tuned with successfully completed and not yet registered job performances. Based on an existing job report and its application gear-list, a correlating "register" number is established to identify the primary and secondary application identities in chapter "Applications".

1.28 Application Core Curriculum 1,000–55,000 psi

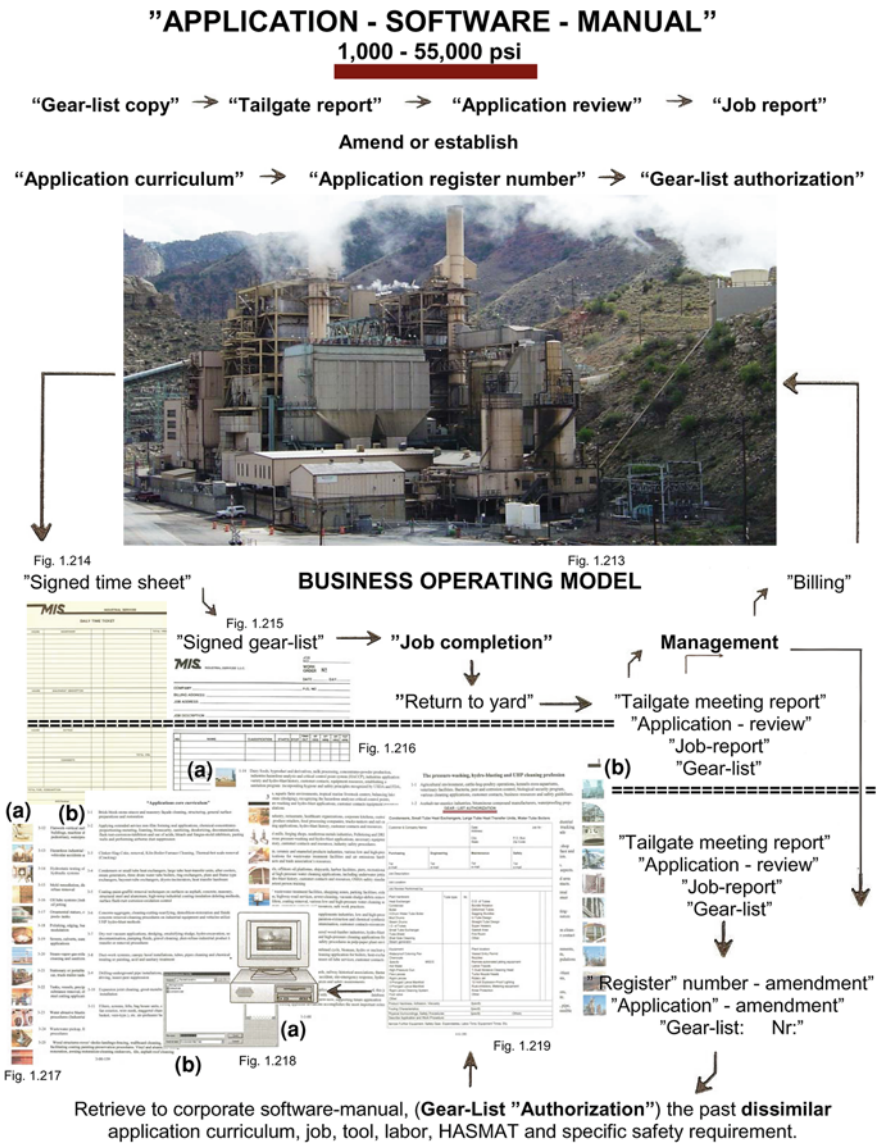
In detail review more than 25 major marine, industrial, and commercial complexes, explaining emerging and existing application techniques. When possible, the pros and cons of prior cleaning or product removal methods, rehabilitation, restoration and demolition practices are compared and referenced. All chapters feature an extensive application "gear-list authorization" which outline the most necessary tools, including support equipment to manage purchasing, sales forces, and operators in their attempt to create a functional "gear-up list". When cross referencing between chapters "Introduction", application "register" and the "Application" core curriculum, everyone involved is equipped to interact with necessary business procedures. The all-important paper trail begins with a job hazardous risk analysis, always followed by a trade "application review", and equipment "gear-list", before a procurement-bidding procedure and work order can be initiated (see Figs. 1.213–1.219)

1.28.1 The Gear-List Authorizations

The gear-list authorizations in Chap. 3 provide and identify the necessary tooling and possible support equipment for over 450 applications within specific environments and include:

1.28.2 GEAR-LIST Authorizations' for

1. Brick–stone–stucco–masonry cleaning, structuring, and restoration
2. Biosecurity, sanitizing, decontamination, chem—concentrate applications



Figs. 1.213–1.219

3. Clinker–slag–coke removal, kiln-boiler-furnace cleaning, thermal-hot scale removal (Cracking-thermal-shock)
4. Condensers, small tube heat exchangers, large tube heat transfer units, tube boilers

5. Coating-paint-graffiti removal on steel, concrete, stone, brick, and wood substrate
6. Concrete cutting, scarifying, surface preparation, demolition and restoration
7. Dry-wet vacu applications, dredging and emulsifying sludge, transfer, gravel cleaning,
8. Corrosion, grease removal, chemically treating and painting (∅) of pipes, ducts, tubes
9. Excavating, drilling, sheet pile driving and water well cleaning
10. Expansion control joint cleaning, sidewalks, tank and pool construction
11. Filters, screens, felts, bag-house units, trays for catalytic-cracking, preheater baskets
12. Cleaning of gas stations, restaurant drive-thru, machine shops and warehousing
13. Hazardous waste recovery, soil treatment, radioactive trace element remediation
14. Hazardous industrial waste, asbestos-ACM product removal
15. Hydrostatic testing of boilers-steam generators, tanks pipelines, gas-vacuum vessels
16. Mold remediation, disaster-sludge cleanup, pest suppression, odor-stench control
17. Oil lube systems, tanks, oil compressors, hydraulic equipment services, light oil jetting
18. Ornamental-statuary-monuments, city fountains, hotel-municipal, aquatic-pools-tanks
19. Polishing, etching, burr-metal flush removal, weld seam polishing, surface modulation
20. Sewers, culverts, sumps, laterals, industrial pipe cleaning, pipeline cleaning and cutting
21. Smoke stacks, laundry shafts and garbage chutes
22. Stationary-portable, equipment, vehicle fleets, rail–car, exterior truck-trailer-tanker
23. Tanks, vessels-autoclaves, precipitators, cleaning, volatile substance-effluent removal
24. Hydro-abrasive blasting, cutting-demolition, underwater hydro-blasting and dredging
25. Wash water control, recovery, filtration, recycling, reclamation technology, evaporation
26. Wood restoration and preservation, vinyl, wood, aluminum siding and roof cleaning

1.29 Application Review

1.29.1 Develop the Trade Curriculum, "Introduction"

Business complex: Agricultural–Aquatic–Marine–Industrial–Commercial–Residential

Trade amendment or a variation to a subdivision in this Chapter, "Introduction": Nr:

Application "Register" numbers: in Chap. 2, "Application Register": Nr:

Recognize, and compare a possible similar application technique identified by "Register" criterion:

Describe and illustrate

Describe and illustrate an innovative or undisclosed application criterion in which the environment, product deterioration, a manufacturing process or it's failure is responsible for equipment fouling, rendering plant hardware inoperable, or is the contaminating source for various surfaces and confined and/or enclosed spaces, predetermining pressure-washing, hydro-blasting, UHP and/or hydro-vac application techniques.

This includes, general cleaning applications on vinyl, wood, aluminum, steel and concrete surfaces, the interior and exterior decontamination of surfaces from various biochemical and chemical hazardous particulate, corrosion-paint-coating removal, UHP applications, various surface treatments as roughening, scarifying and anchor profiling techniques, hydro-abrasive blasting, hydro-static testing, liquid jetting other than water, industrial pipe and sewer cleaning applications, dredging and commercial industrial vacuum services, and providing an emergency response capability in industrial–commercial–residential environments to remove waste-sludge-liquids or gravel-granulate-dust accumulations. This application curriculum can be expanded to a HAZMAT response to act on environmental emergencies (storm cleanup), and make available mold-fungus remediation solutions, fire restoration, accident or crime scene mitigation.

Contacts. Identify company contacts, purchasing, contracting office, engineering and maintenance departments

Resources. Identify customers trade related information base, associations, state and federal government trade oversight departments and regulations:

Safety procedures, Jobsite specific. Proof of necessary written, tested licensed trained and/or retrained contractor-crew proficiency and classification for technical, safety, legal and health requirements:

Developed by: Date:

Authorized by: Date:

"INTRODUCTION"

DEVELOP THE TRADE CURRICULUM - amendment

Customer, Company: Web site: e-mail:		Date: Nr: Address: City: P.O. Box: State: ZIP Code:	
Purchasing	Engineering	Maintenance	Safety
Tel: e-mail:	Tel: e-mail:	Tel: e-mail:	Tel: e-mail:
Jobsite specific: safety requirements, equipment-procedures, pedestrian-vehicular traffic control: Atmospheric and physical hazards: Biological or sanitary application criterion:			
Job Location: Area: Job access requirements: Lock-out and tag-out procedures: Step-in and out area:			
Job Site Review: Previous service methods: Process equipment-hardware identification and failure analysis: Debris identification, and hazardous material classification: Debris-scale, adhesion classification, tensile strength, resilience, viscosity and volume: Required tooling and its performance estimates: Itinerary of proposed service action: Pre-job safety meeting itinerary: Tailgate meeting itinerary:			
Labor force-contractor specific: safety equipment and procedures:			
Developed by: Date: Authorized by : Date:			

WORKSHEET- ENGINEERING - FIELD-TECH

APPLICATION REVIEW

Customer, Company: Web site: e-mail:		Date: Nr: Address: City: State: P.O. Box: ZIP Code:	
Purchasing	Engineering	Maintenance	Safety
Tel: e-mail:	Tel: e-mail:	Tel: e-mail:	Tel: e-mail:
Job Description:			
Job Location:	Job-Site, Hazard Risk Assessment:		Specify:
Job Site Review:			
Safety equipment and procedures:			©
Developed by: Authorized by:		Date: Date:	

WORKSHEET- ENGINEERING - FIELD-TECH

1.30 Compile Application Register Catalog

Marine–Agricultural–Aquatic–Industrial–Commercial–Residential

"Register" numbers are "branded by" business and industry identification or manufacturing hardware and process, identity of an service industry and particular business practice, type of product to be removed, area identification, or environmental and disaster terminology.

When a job conclusion has proven successful by conforming to all safety merits within its performance criteria, the successful application criterion and previously undisclosed job description is amended to chapter "Application". The information includes labor force necessities, and gear/tool selections which are identified and categorized by their "Index" primary numeric number (bold).

Secondary "Index" numbers apply either to application similarities or an application criterion necessary within a specified primary job description. With a winning job curriculum derived from an "application review" its "Gear-list", job report, and job cost analysis, the application "Register" is chronologically expandable and/or fine-tuned by establishing a correlating "Register" number to the core "Application" curriculum Fig. 1.220.

"COMPILE APPLICATION REGISTER CATALOG"

Marine - Agricultural - Aquatic - Industrial - Commercial – Residential

"Register" numbers are "branded by" business and industry identification or manufacturing hardware and process, identity of an service industry and particular business practice, type of product to be removed, area identification, or environmental and disaster terminology.

When a job conclusion has proven successful by conforming to all safety merits within its performance criteria, the successful application criterion and previously undisclosed job description is amended to chapter "Application". The information includes labor force necessities, and gear/tool selections which are identified and categorized by their "Index" primary numeric number (bold).

Secondary "Index" numbers apply either to application similarities or an application criterion necessary within a specified primary job description. With a winning job curriculum derived from an "application review" its "Gear-list", job report, and job cost analysis, the application "Register" is chronologically expandable and/or fine-tuned by establishing a correlating "Register" number to the core "Application" curriculum.

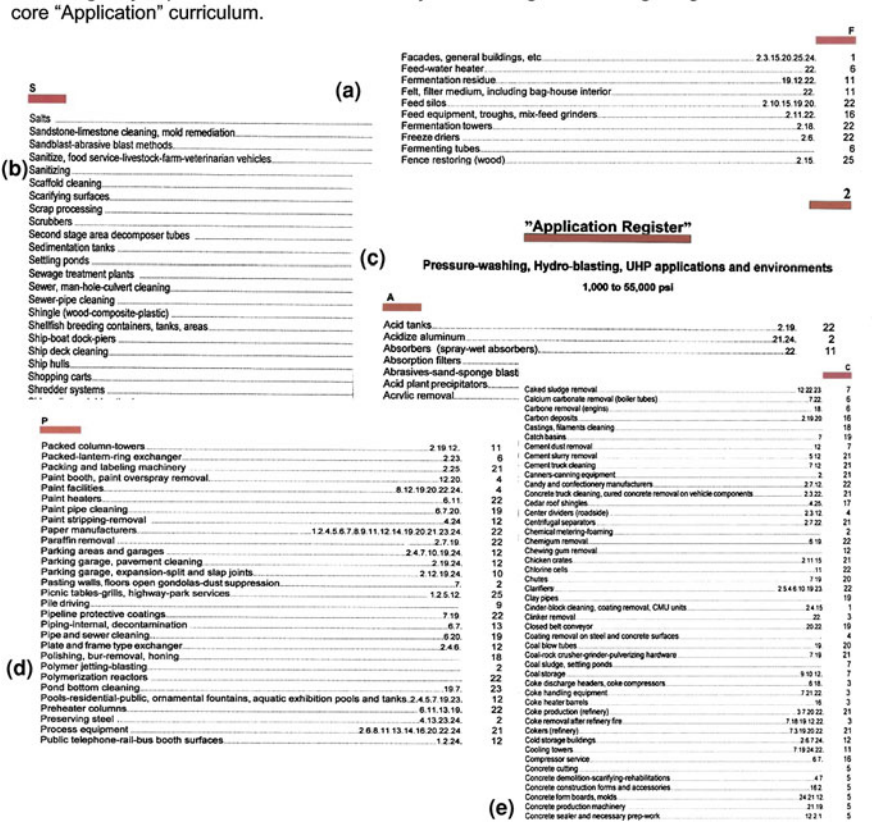


Fig. 1.220

GEAR - LIST Nr.

Customer & Company: Web site: e-mail:		Date: Job Nr.: Address: City: P.O. Box: State: Zip Code:	
Purchasing Tel: e-mail	Engineering Tel: e-mail	Maintenance Tel: e-mail	Safety Tel: e-mail
Job Description:			
Job Location:	Job-Site, Hazard Risk Assessment:		Specify:
Job Review Performed by:			

Plant hardware, equipment, surface area: Establishing a new "Gear-list" prepared by an actual job walk and its subsequent informative job "Review" is greatly supported by choosing job criteria from the abundant but specific "Gear list Authorization" located within the core "Application" chapter. Identifying labor force safety requirements, and transferring or adding relevant itinerary, and tooling to a gear-list can only be established by a job-walk, qualified application review and a precise up-to-date job recording program to the core "Gear-list". Plant location:				Hydro-blast equipment: Expendables:			
Product Encountered:							
Hazardous Material:		MSDS:		Specify:			©

Describe Application and Work Procedure:

Describe Safety Procedure:

Itemize Equipment, Safety Gear, Expendables, etc.:

Developed by: Date:
Authorized by: Date:

GEAR - LIST Nr.

Customer & Company: Web site: e-mail:		Date: Job Nr.: Address: City: P.O. Box: State: Zip Code:	
Purchasing Tel: e-mail	Engineering Tel: e-mail	Maintenance Tel: e-mail	Safety Tel: e-mail
Job Description:			
Job Location:	Job-Site, Hazard Risk Assessment:		Specify:
Job Review Performed by:			
Plant hardware, equipment, surface area:		Hydro-blast equipment:	
Plant location:		Expendables: Other:	
Product Encountered:			
Hazardous Material:	MSDS:		Specify:

Developed by: Date:
Authorized by: Date:

"GEAR-LIST AUTHORIZATION" - amendment

Customer & Company: Web site: e-mail:		Date: Job Nr.: Address: City: P.O. Box: State: Zip Code:	
Purchasing Tel: e-mail	Engineering Tel: e-mail	Maintenance Tel: e-mail	Safety Tel: e-mail
Job Description:			
Job Location:	Job-Site, Hazard Risk Assessment:	Specify:	©
Job Report Performed by:			

Establishing a new and innovative Gear-list "Authorization" or amending an existing one within the "Application" Core chapter, requires an application review criteria encompassing a **dissimilar** access to a jobsite, unlike or unknown application histories (job reports), with a **dissimilar** track record and related narration (gear-list), unequal surface-substrate or location, **dissimilar** manufacturing process or failure, product or environmental conditions, **dissimilar** safety requirements, safety equipment and personal protective gear necessities (PPE).

The mere fact of obvious product adhesion similarities, and/or comparable product-scale removal application techniques does not justify a gear-list "authorization" procedure or changes to an existing one.

Product Encountered:			
Hazardous Material:	MSDS		Specify:

Describe Application and Work Procedure:

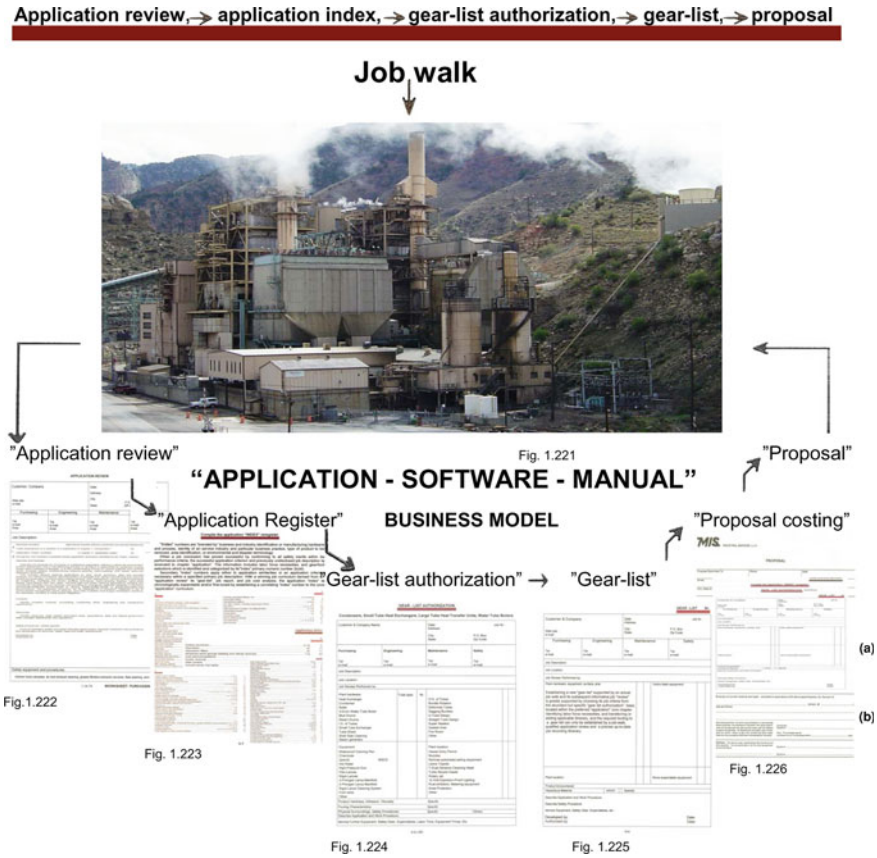
Describe Safety Procedures:

Itemize Equipment, Safety Gear, Expendables, etc.:

Developed by: Date:
Authorized by: Date:

"GEAR - LIST AUTHORIZATION" - amendment

Customer & Company: Web site: e-mail:		Date: Job Nr.: Address: City: P.O. Box: State: Zip Code:	
Purchasing Tel: e-mail	Engineering Tel: e-mail	Maintenance Tel: e-mail	Safety Tel: e-mail
Job Description:			
Job Location:	Job-Site, Hazard Risk Assessment:	Specify:	©
Job Review Performed by:			
	Expendables: Other:		
Product Encountered:			
Hazardous Material:	MSDS		Specify:
Developed by: Authorized by:		Date: Date:	



Figs. 1.221–226

A job walk identifies application criteria recorded in detail utilizing the "Application Review Form". The encountered application is clarified by engineering and/or industries terminology, manufacturing hardware and/or process, services identity or its practice, type of product to be removed, area identification or environmental and disaster vocabulary ("Register Catalog").

Identifying the application by its terminology, reveals primary (bold) and secondary numbers ("Register Catalog") recognizing the specific core "Application Curriculum" supported by an industry specific "Gear-list Authorization" categorizing necessary tooling, equipment and safety procedures for a "Gear-list" creation facilitating the proposal requirement.

Creating a "Gear-list" for a proposal procedure must always involve the "Gear-list authorization" curriculum eliminating time, labor, proposal and technical application irregularities.

APPLICATION REVIEW

Customer, Company: Web site: e-mail:		Date: Nr: Address: City: State: P.O. Box: ZIP Code:	
Purchasing	Engineering	Maintenance	Safety
Tel: e-mail:	Tel: e-mail:	Tel: e-mail:	Tel: e-mail:
Job Description:			
Job Location:	Job-Site, Hazard Risk Assessment:		Specify:
Job Site Review: Expendables:			
Safety equipment and procedures:			
Developed by: Authorized by:			Date: Date:

WORKSHEET- ENGINEERING - FIELD-TECH

Individual and/or specific application requirements justifying the development of a new “Gear-list Authorization” must confer with the business system 1,000 psi to 55,000 psi maintaining software-manuals integrity (Administration) (Figs. 1.221–1.226).

"GEAR - LIST AUTHORIZATION"

Customer & Company: Web site: e-mail:		Date: Job Nr.: Address: City: P.O. Box: State: Zip Code:	
Purchasing Tel: e-mail	Engineering Tel: e-mail	Maintenance Tel: e-mail	Safety Tel: e-mail
Job Description:			
Job Location:	Job-Site, Hazard Risk Assessment:	Specify:	©
Job Review Performed by:			
		Expendables: Other:	
Product Encountered:			
Hazardous Material:	MSDS	Specify:	
Developed by: Date: Authorized by: Date:			

MANAGEMENT

"GEAR - LIST AUTHORIZATION" - amendment

Customer & Company: Web site: e-mail:		Date: Job Nr.: Address: City: P.O. Box: State: Zip Code:	
Purchasing Tel: e-mail	Engineering Tel: e-mail	Maintenance Tel: e-mail	Safety Tel: e-mail
Job Description:			
Job Location:	Job-Site, Hazard Risk Assessment:	Specify:	©
Job Review Performed by:			
	Expendables: Other:		
Product Encountered:			
Hazardous Material:	MSDS	Specify:	
Developed by: Date: Authorized by: Date:			

MANAGEMENT

GEAR - LIST Nr.

Customer & Company: Web site: e-mail:		Date: Address: City: State:	Job Nr.: P.O. Box: Zip Code:
Purchasing Tel: e-mail	Engineering Tel: e-mail	Maintenance Tel: e-mail	Safety Tel: e-mail
Job Description:			
Job Location:	Job-Site, Hazard Risk Assessment:		Specify: ©
Job Review Performed by:			

Plant hardware, equipment, surface area:			Hydro-blast equipment:			
Plant location:			Expendables: Other:			
Product Encountered:						
Hazardous Material:	MSDS:		Specify:			

Developed by: Date:
Authorized by: Date:

GEAR - LIST- SHOP-YARD